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THE TELEGRAPHIC JOURNAL AND
Electrical Review.
VOL. XVI.—NO. 390.

OVERHEAD WIRES.

THE report of the Parliamentary Committee with reference to telegraph and telephone wires, published in our columns this week, appears to us likely to be confirmed. Not only are aerial wires to be permitted to be erected, but increased facilities in the way of compulsory powers are, by it, recommended. Under these powers, wires may be carried over land or buildings without the consent of the owners of the latter. The plain fact, that in spite of the enormous numbers of overhead wires existing, the accidents which have occurred from their breakage have been very few, has no doubt greatly influenced the decision; the critical condition, also, in which the telephone companies themselves would be placed by a regulation forcing them to substitute underground for overhead circuits must also have had an effect. Apparently steps will be taken towards bringing the wires under supervision, and the further powers which are given for their erection now render such supervision, more than ever, important. The great improvements which have taken place within the last few years in the manufacture of telegraph wire, as regards the tensile strength of the latter, no doubt renders breakages less liable to take place than formerly, provided sufficient care is taken in making proper attachments; the use of hard drawn copper wire, especially, is a great step in advance, as this material while possessing high conductivity is of extraordinary tenacity. The favourable nature of the decision has been shown by a marked increase in the market value of telephone shares and it may stimulate telephonic enterprise to a great extent, more especially if the way can be seen clearly to reduce the present somewhat excessive rates which the public have to pay for their privilege of intercommunication. The question of the unsightliness of the ærial wires has, we notice, been entirely left out of question, and little hope is left that the disfigurement of our streets will be considered or that some neater and more systematic arrangement of the wires will be adopted.

Extension of Telephone System.—The National Telephone Company last week completed the new line to Coatbridge and Mossend, connecting its Glasgow exchanges with these places. The company has opened an exchange in Coatbridge, with which Coatbridge and Mossend firms are connected, and has made a start with 11 subscribers in Coatbridge and three in Mossend. The wires are working admirably, and the speaking is as clear as in a short distance. Since their erection the wires have been kept constantly at work. It is purposed to keep the Coatbridge exchange open day and night.

THEORETICAL AND EXPERIMENTAL RESEARCHES ON THE SECONDARY GENERATORS OF GAULARD AND GIBBS.

By PROFESSOR GALILEO FERRARIS.

(Continued from page 416.)

By reason of the variations of speed of the dynamo machine and of the intensity of the primary current, variations which, as we have observed a little before, could not be entirely avoided in our experiments, the determination of C could not be made with the data of the calorimetrical experiments with a certainty equal to that with which u is calculated. But it will be seen that an error in the value of C gives place to a minimum error in the value of the coefficients of yield, u and v, and hence the circumstance in question will not injure the accuracy of the determination of the practical yield of the secondary generator.

In order to determine C by means of the results of our experiments, we may proceed in three distinct ways:—

1. We may make use of the formula

$$u\,\frac{t - t_0}{t' - t'_0} = 1 + \frac{r'^2}{C^2}$$

and hence

$$C^2 = \frac{r'^2}{u\,\frac{t - t_0}{t' - t'_0} - 1} \qquad (58)$$

2. We may make use of the formula (27), which gives the value of C as a function only of the resistances measured in the experiments. From this formula there follows in fact

$$C^2 = \frac{r_1^2 - \rho^2}{(r' + \rho)^2 - r_1^2}\,r'^2$$

or also

$$C^2 = \frac{(r_1 + \rho)\,(r_1 - \rho)\,r'^2}{(r' + \rho + r_1)\,(r' + \rho - r_1)} \qquad (59)$$

a formula more convenient for logarithmic calculation.

3. We may finally use the formula

$$C^2 = r_1^2 - \rho^2 \qquad (28')$$

which gives the value of C by means of the sole resistance r_1 measured in the experiment with the secondary circuit open.

But the consideration that there must have happened errors which may be caused by accidental and sometimes considerable variations which between the first and the second part of one and the same experiment must have occurred in the strength of the primary current, and the length, T, of the period, makes it be foreseen that the two first methods cannot lead us to a certain and exact determination of value of C.

Besides the form of the formulæ (58) and (59) is such that an error of observation committed in the determination of $\frac{t - t_0}{t' - t'_0}$ or of r_1 may produce enormous errors in the value of C. And in fact in the first of our experiments we have:

$$\frac{t - t_0}{t' - t'_0} = 1{\cdot}043,\; u\,\frac{t - t_0}{t' - t_0} - 1 = 0{\cdot}032$$

which means that an error of $\frac{1}{100}$ in the value of $\frac{t - t_0}{t' - t'_0}$ produces an error of one-third in the value of the denominator of the expression for C, and consequently in C itself; an error of $\frac{2}{100}$ equal to the mean which occurred in our measurements would produce an error in C equal to two-thirds of the value of C itself.

If, then, the difference is referred to r_1, we find

$$\frac{d\,(C^2)}{d\,r_1} = 2\,r_1\,r'^3\,\frac{r' + 2\,\rho}{[\,(r' + \rho)^2 - r_1^2]^2},$$

whence an error of $\Delta\,r_1$, committed in the determination of r_1, involves an error $\Delta\,(C^2)$ in C^2, whence

$$\Delta\,(\mathrm{C}^2) = 2\, r_1\, r'^3 \frac{r' + 2\,\rho}{[\,(r' + \rho^2) - r_1^2]^2}\,\Delta\, r_1\,;$$

therefore

$$\frac{\Delta\,(\mathrm{C}^2)}{\mathrm{C}^2} = \frac{2\, r_1^2\, r'\,(r' + 2\,\rho)}{(r_1^2 - \rho^2)\,[\,(r' + \rho)^2 - r_1^2]}\,\frac{\Delta\, r_1}{r_1},$$

which means that

$$\frac{\Delta\,(\mathrm{C}^2)}{\mathrm{C}^2} > \frac{2\, r'\,(r' + 2\,\rho)}{(r' + \rho)^2 - r_1^2} \cdot \frac{\Delta\, r_1}{r_1}.$$

If we insert in this formula the values

$$r' = 4{\cdot}70,\ r_1 = 4{\cdot}80,\ \rho = 0{\cdot}28,$$

as they were in our first experiment,

$$\frac{\Delta\,(\mathrm{C}^2)}{\mathrm{C}^2} > 25\,\frac{\Delta\, r_1}{r_1}.$$

A relative error of $\frac{2}{100}$ committed in the measurement of r_1, an error probable in our experiments and not greater than that due to the accidental variations of the primary current would involve a relative error exceeding $\frac{50}{100}$ in calculating the value of C^2.

The third method, based upon the use of the formula

$$\mathrm{C}^2 = r_1^2 - \rho^2, \qquad (28')$$

offers much greater security. The use of the formula (28′) does not permit us to utilise the results of a single experiment, but such an experiment consists in reading off the deviations of the electrometer and of the electrodynamometer whilst the secondary generator is in action with an open secondary circuit, and then substituting for the secondary generator the resistance r_1.

This resistance is found in such a manner that the deviation of the electrometer may have its primitive value, and is then tried again with the secondary generator by a simple turn of the commutator, and thus the perfect constancy of the deviation of the electrometer can be many times verified in a very short time. In this manner all doubt that the measure may be interfered with by an accidental variation of the strength of the current is completely excluded.

Since ρ is small, the relative error in the value of C, calculated from (28′), is approximately equal to that committed in the measurement of r_1, and the relative error in the value of C^2 is simply its double.

We shall make use of this procedure for determining the value of C, which we require for the use of our formulæ.

If we insert in (28′) in the place of ρ the value 0·28, and in place of r_1 the value

$$r_1 = 22{\cdot}36$$

found in the experiment No. 14 made with an open secondary circuit we have:

$$\mathrm{C}^2 = 500{\cdot}1 \qquad (60)$$

which is the value we shall employ.

It deserves to be noted that this value differs little from the arithmetical mean of the mean values calculated roughly with the formulæ (58) and (59); the mean of the values obtained with (58) is 512, that of the values from (59) is 477, the mean of these two means is 494.

It is necessary to observe that an error, although great, committed in the determination of the constant C will introduce in any case a minimum error in the calculation of the yield. To be convinced of this it is sufficient to observe that on making the value of C^2 to vary from 460 to 500, the values of the coefficient of theoretical yield, u, calculated by the formula (36) do not vary within the limits of our experiments by $\frac{1}{1000}$.

As it is absolutely impossible that the value (60) of C^2 which we have determined by means of the formula (28′) can be affected by an error of the magnitude of the difference between 460 and 500, we may regard it as certain that on calculating the coefficients of effective yield by multiplying the coefficients of theoretical yield by u, we obtain results the probable relative error of which is equal to that which may exist in the mean value of u before determined. The procedure is therefore, as we have asserted, susceptible of great precision.

In the following table are comprised the coefficients of theoretical yield and the coefficients of practical external yield, calculated in the manner above described from a series of the values of the resistance of the scondary circuit.

In this table are registered:

In the column headed r' the values of the total resistance of the secondary circuit varying by 2 ohms from 0·28 to 40.

In the column headed μ the theoretical values of the coefficient of total yield calculated by means of the formula (36).

In the column headed v the values of the coefficient of external theoretical yield calculated by means of the formula (37).

In the column headed (v) the values of the coefficient of external practical or effective yield, calculated by multiplying the theoretical coefficient v by the number u obtained experimentally.

The calculations was based upon the data

$$\rho = \rho' = 0{\cdot}28$$

$$\mathrm{C}^2 = 500,\ u = 0{\cdot}99$$

The coefficients of theoretical yield are carried out to three decimal places the better to show how these magnitudes vary in the neighbourhood of their maximum. On the other hand, the coefficients of practical yield (v) which like the ratio u which has served in their calculation, can present a probable error of about 0·004 are given in two figures only.

Theoretical and practical coefficients of yield with the secondary generator connected in series.

r'	μ	ν	(ν)	r'	μ	ν	(ν)
0·28	0·500	0·000	0·00	22	0·976	0·963	0·95
2	0·876	0·753	0·74	24	0·976	0·964	0·95
4	0·933	0·867	0·86	26	0·975	0·964	0·95
6	0·956	0·911	0·90	28	0·975	0·965	0·95
8	0·962	0·928	0·92	30	0·975	0·966	0·96
10	0·967	0·940	0·93	32	0·974	0·966	0·96
12	0·971	0·948	0·94	34	0·973	0·965	0·95
14	0·973	0·954	0·94	36	0·973	0·965	0·95
16	0·974	0·957	0·95	38	0·972	0·965	0·95
18	0·975	0·959	0·95	40	0·971	0·964	9·95
20	0·975	0·961	0·95				

In the theoretical part of this investigation we have demonstrated that the coefficients of total and external yield, μ and ν, have a maximum value for the determined values of the resistance, r', of the secondary circuit; and we have seen that these values of the resistance and the maximum values which correspond to them may be calculated by means of the formulæ (36′), (36″) and (37′), (37^{iv}). With the results of our experiments we can find these values for the case of the secondary generator which we are studying.

According to (36′) the r' which brings the coefficient of total yield, μ, to a maximum is

$$r' = \mathrm{C}.$$

With the apparatus experimented upon the maximum of the total yield corresponds therefore to the resistance

$$r' = \sqrt{500},$$

therefore to

$$r' = 22{\cdot}36.$$

The value of the maximum is, according to the formula (36″),

$$\mu_m = \frac{\mathrm{C}}{\mathrm{C} + 2\,\rho'},$$

therefore in the apparatus used

$$\mu_m = \frac{22{\cdot}36}{22{\cdot}36 + 0{\cdot}56},$$

therefore

$$\mu_m = 0{\cdot}976.$$

As, further, the formula (37′) shows that the maximum of the coefficient of external yield, ν, corresponds to :—

$$r' = \rho' + \sqrt{\rho'^2 + \frac{\rho + \rho'}{\rho}\, C^2},$$

in our case, therefore,

$$\rho = \rho' = 0{\cdot}28 \text{ and } C^2 = 500,$$

which corresponds to

$$r' = 0{\cdot}28 + \sqrt{1000{\cdot}08},$$

therefore to $r' = 31{\cdot}90$ ohms.

And the value of the maximum which, according to (37^{iv}), is

$$\nu_m = \frac{C}{C + 2\,\rho\,\sqrt{2}},$$

and in our case

$$\nu_m = \frac{22{\cdot}36}{22{\cdot}36 + 0{\cdot}79};$$

hence $\nu_m = 0{\cdot}966,$

which is the theoretical maximum; the practical maximum is

$$(\nu_m) = 0{\cdot}99\ \nu_m = 0{\cdot}96.$$

The table of the values of μ and of ν shows that in the vicinity of the values of r', as calculated, the coefficients of yield vary very slowly and remain practically equal to their respective maxima.

SEC. 12.—*Another determination of the practical yield.*

The method which we have followed in the foregoing paragraph for calculating the coefficient of yield is, as we have shown, the best which can be followed, taking account of the special circumstances in which our experiments have been performed and of the causes of error which may have exerted an influence. But now we have determined the most probable values of such coefficients it is not useless to see what results would follow from the other method to which reference has been made above. It will be a method of checking the accuracy of the theory by experiment.

The procedure to which we have alluded, and which we are now going to work out, consists in deducing the values of μ from those of m by means of the formula (44), therefore from

$$\mu = \frac{m}{\sqrt{1 - \left(\frac{r'\,m}{C}\right)^2}}. \qquad (44)$$

We will insert in this formula in place of C^2 the value 500, which we have determined in the foregoing paragraph, and in place of r' and of m successively the values registered in the table in Sec. 10.

The coefficient of total effective yield being thus calculated for each separate experiment, a coefficient which, to distinguish it from the theoretical, we will call (μ), we will calculate for each experiment the theoretical value of μ from the formula (36), therefore from

$$\mu = \frac{r'\,C^2}{\rho\, r'^2 + (r' + \rho)\, C^2} \qquad (36)$$

The value of μ being thus calculated we make the quotient

$$\frac{(\mu)}{\mu} = u$$

and have thus for each experiment the relation between the effective and the theoretical yield. We shall then be able to form the mean of the values of u and to compare it with that obtained by the better method followed in the foregoing paragraph.

The results of such a calculation are registered in the following table, in which the first column contains the successive number of the experiments; the second, the resistance, r', of the secondary circuit; the third, the coefficients of theoretical yield, μ, calculated from (36); the fourth, the coefficients of practical yield, (μ), calculated from (44); the fifth, the ratios $u = \frac{(\mu)}{\mu}$; the sixth, the difference, δ, between the separate values of u and their arithmetical mean, and the seventh, the squares, δ^2, of this difference.

Comparison between the coefficients of practical yield calculated from (44) *and the theoretical coefficients calculated from* (36).

No. of experiment.	r'	μ	(μ)	u	δ	δ^2
1	4·70	0·94	0·96	1·02	+ 0·02	0·004
2	5·09	0·94	0·93	0·98	− 0·02	4
3	6·10	0·95	0·93	0·97	− 0·03	9
4	6·80	0·96	0·94	0·98	− 0·02	4
5	7·73	0·96	0·95	0·98	− 0·02	4
6	10·02	0·97	0·95	0·98	− 0·02	4
7	10·02	0·97	0·96	0·99	− 0·01	1
8	12·12	0·97	0·96	0·99	− 0·01	1
9	15·43	0·97	0·96	0·99	− 0·01	1
10	17·70	0·97	0·95	0·97	− 0·03	9
11	17·73	0·98	1·01	1·04	+ 0·04	16
12	19·80	0·98	1·03	1·05	+ 0·05	25
13	21·50	0·98	1·02	1·05	+ 0·05	25
$n = 13$			Mean =	1·00	$\Sigma\,\delta^2 =$	0·0107

$$\sqrt{\frac{\Sigma\,\delta^2}{n-1}} = 0{\cdot}03\ ,\quad \sqrt{\frac{\Sigma\,\delta^2}{n\,(n-1)}} = 0{\cdot}008\ .$$

There will result, therefore, $u = 1$, but with an error probably greater than 0·005. And as this error will certainly be plus, the only thing that can be concluded from this calculation is that u lies between 0·99 and 1. It is important to note that this calculation will be still certain. In fact, the high value of the mean, u, is due to the three last experiments, in which certainly some special cause of error has been at work. These experiments were executed on the last day, in which, as we have pointed out, it was impossible to avoid notable variations in the intensity of the primary current. The differences, δ, have in these experiments values much greater than in all the others, and as all three are positive, whilst all the others, save only the first, are negative. The fact that the greatest part of the differences are negative and that the positive differences do not alternate with the negative, leads us to think that the mean, u, on the basis of which the differences have been calculated, may have fallen out greater than the truth by reason of a considerable error in the few experiments which have given positive differences.

The more probable value of u by this method will not be equal, but somewhat less than its calculated mean.

With this observation the agreement between the conclusion drawn from the actual calculation to which the method (evidently better) has led us, appears more complete.

Meanwhile these results with all the differences which they present—divergencies which I have foreseen—justify the selection which we have made of the first method, and are at the same time sufficiently accordant to prove the practical validity of the formulæ supplied by theory.

(*To be continued.*)

The Erection of Telephone Posts.—At the meeting of the Portsmouth Town Council last week, the Town Clerk stated that the Western Counties and South Wales Telephone Company had made arrangements with the corporation regarding the erection of telephone posts, and had paid rents for all the posts erected, but he could not say whether the company was assessed to the poor rates.

CENTRAL STATION LIGHTING.

OUR transatlantic cousins are considerably ahead of us Britishers in the organisation, equipment, and practical working of central stations for electric lighting. Still, there are in London alone several large installations of this kind gradually approaching completion, and whether the ultimate result of these experiments will be one of success or failure, it certainly would not conduce to the latter if a few hints were taken from the experience gained in America. The following extracts, selected from a paper on central station lighting by Mr. W. J. Jenks, which we find in our New York namesake, will not, we feel sure, be found unacceptable to the majority of our readers. Mr. Jenks commences by remarking that the field of central station lighting by incandescence is comparatively untrodden. In all the United States only four systems are in operation where the distribution of electric currents for light is effected through underground conductors, after the general plan pursued by the gas companies. At Brockton, Mass., the Edison, as yet the only system of central station lighting by low tension currents, was offered to the public October 1st, 1883. As might reasonably be expected, some grave mistakes were made in the general policy first inaugurated.

For instance, in a manufacturing city where land (as near the centre of trade as the station of an incandescent plant should be) is valuable, a room with power is always at a premium.

The Edison building was, however, devoted only to the illuminating business, while the station of the Thomson-Houston Company, since erected, has paid a good income on its entire cost by the rental of two floors with about 10-horse power, at upwards of $2,000 per year.

Inexperience in the mechanical details of installation resulted in faulty construction, especially in the vital matter of laying the underground conductors; this has not been repeated in later systems, and need never be encountered in future.

The sectional boilers first installed have proved less economical and satisfactory than a tubular boiler added last summer.

An exhaust injector, supplying water from the street mains to the boilers against a steam pressure of 100 pounds, at a temperature of 150° to 160° was used for the first six months. Its intermittent action, necessitating constant watchfulness, proved a decided drawback to its usefulness where the duties of engineer, dynamo and regulator attendant and fireman, devolved upon one man. The use of the national heater, which was finally secured, effected a saving of 5 to 7 per cent. in fuel by supplying the feed water at 210° to 212°, the pump maintaining a nearly constant level in the gauges.

The attempt to use short belts obliged them to be run so tight that extra oil, of higher cost than would otherwise have been necessary, was demanded, and even then the loss of power was shown by a degree of heat at the bearings of the armatures, calling for a constant application of water, and accompanied, in the case of a heavy load, by a notable pulsation of the lights.

The works were started with a small number of lamps connected, less than one-quarter of the quota required to pay expenses, and customers were expected, from the first, to bear the entire cost of wiring their residences and places of business, even before the test of time had convinced the public of its reliability and adaptation to their necessities or convenience.

The Illuminating Company attempted to do their own wiring of buildings, and found themselves in the position which a gas company would occupy if endeavouring to carry on both the business of manufacturing gas and that of piping. It is not strange that in this department mistakes were made which have since been corrected at considerable cost. The result was the forming of a separate organisation, to take the business of inside wiring entirely into their hands, latterly known as the New England Wiring Company. Thus, as an outgrowth of disadvantageous circumstances, sprung an auxiliary which has proved a most valuable aid to the progress of the enterprise, and whose experience may be made available in future systems.

All the disadvantages here only hinted at combined to present so severe a test of the real money-making capabilities of the system that special force attaches to the fact that the legitimate running expenses of the station for the year ending September 30th, 1884, together with some extraordinary outlays not likely to become necessary in future, were paid by the income, and that the returns for the five months since that date indicate that a dividend will be earned the present year.

A few other scraps of history and experience will, perhaps, be valuable to inquirers :—

Number of 10-candle lamps at starting station	200
Number connected October 1st, 1884 ...	2,000
Population of Brockton January 1st, 1885, (about)	20,000
Price of gas October 1st, 1883	$2.25
Present price	2.00
Price of 10-candle Edison lamp (equivalent to average 5-foot gas burner), 1 cent. per hour, cost of power (about) $60 per H.P. for the first year of 365 days of 10 hours.	
Average H.P. used in light production for the year 1884, 365 days of 13 hours each ...	40
Number of Edison 10-candle lamps supplied with current, per indicated H.P.	10

Capital and Expenses

estimated for a 1,600-light underground plant (corresponding with perhaps 3,000 lamps actually installed) in a town or small city with fairly compact business district :—

Capital, covering franchises for central station and isolated lighting, complete installation of plant with single set of machinery, and cash $5,000 for construction and other outlays during first year after starting station	$55,000
Average running monthly expenses of plant, when 2,500 10-candle lamps are installed, and 1,000 in actual average use, say, four hours every day (engines running from dark to daylight)—	
Coal, three parts screenings (say, $3.25 per net ton), and one part Cumberland (say $4.75), using Jarvis furnace	200.00
Oil and waste	17.00
Water, 125,000 gallons, say, 20 cents per 1,000 gallons	25.00
Lamps	150.00
Salaries, manager, meter man, engineer, and fireman, say	250.00
Average depreciation, 5 per cent. per year on $25,000	104.00
Insurance, $20,000 at 1 per cent.	17.00
Taxes	30.00
Incidentals, including meter supplies, $10; telephone, $4; stationery, $3; and travelling, $5	22.00
Monthly total	$815.00
Gross income, 4,000 lamp hours per day ...	$1,200.00

Net profit per year on this monthly average, 8½ per cent. on capital stock.

The above estimates, though based upon the experience of the Brockton plant, do not in several respects agree with the results there secured. They rather indicate what should be and what may be attained, under ordinary circumstances, if proper provision for reasonable economy is made in construction of the station.

The electrical machinery of the Brockton station has, in the main, proved so satisfactory as to leave little to be desired which, in the present stage of scientific progress, it seems possible to supply. Very recently some modifications of the 450-light dynamos have brought their capacity fairly up to 400 ampères and 125 volts, thus enabling them to provide for the loss of about 15 per cent. in feeders, mains and inside wiring of buildings, and still maintain 800 10-candle lamps requiring 110 volts to develop their normal light. The fact that this result is obtained, while reducing the speed from 1,200 to 900 revolutions per minute, is one of the most gratifying recently brought out. This makes it possible to use 58-inch driving pulleys on the engine (in place of 66-inch) at 250 revolutions and 16-inch on the dynamo (instead of 14-inch), and while retaining as available the normal power of the engine, and all the sensitiveness of its centifugal governor, secure the maximum work of the dynamo with less heating of the bearings, less oil, and less wear of the commutator and brushes.

It has been objected to the methods of the Edison central stations that no automatic regulation is provided. Without doubt this will be secured; but those who criticise appear to forget that a compound winding, which some have loudly proclaimed as a panacea for all incandescent ills, simply aims to maintain a constant potential *at the dynamo* (and, of course, practically, in isolated systems, throughout a building), while this is exactly what a central station machine must not do, as varying loads are accompanied by varying percentages of drop in electromotive force between the dynamo and the objective point—the lamp.

The delicate Edison indicator shows the watchful engineer a variation of 1 per cent. in the number of lamps in use, and in the case of a large theatre whose lights may aggregate from 25 to 50 per cent. of the entire load on the system, it has been found convenient to use a special wire connecting a small signal bell and key on the stage with a mechanical gong at the station end, and enabling either party by a code of signals to ascertain at any moment the circumstances of the other, and give warning of sudden changes.

The City theatre opened in October last was the first in this country to be lighted by incandescent lamps by current from a central station metered like gas. The 500 lights distributed over the stage, auditorium, corridors, dressing rooms and approaches, form the only method of illumination, and as a matter of additional precaution, current is received from two services, drawing from the mains at points widely separated. In a smaller theatre since fitted, and in two large skating rinks, well-grounded confidence has entirely excluded other methods of general lighting. The satisfaction realised as to quality and quantity is emphasised by the fact that after months of service by meter, the rinks have contracted with the Edison Company for the season on mutually agreeable terms. The managers of the larger theatre, where the use of the light is intermittent, manifest no disposition to find fault with the meter bills.

It would be difficult to find an engine better adapted to the exactions of central station work than the Armington and Sims automatic cut-off, with the latest improvements, including relief valves, preventing the possibility of accident from water in the cylinder. With fairly even pressure of steam, the regularity of its action under the sudden changes of load which constantly occur, is surprising, and when its full power is brought out in a case of short circuiting of the main conductors, when in the twinkling of an eye its burden may be multiplied perhaps ten-fold, perhaps twenty-fold, its performance excites admiration, and constitutes one of the safeguards of the system, enabling the dynamos to melt out the obstruction and continue their work. The high-speed engine, belted direct to the dynamo, may justly be regarded as one of the corner stones of the successful electric light station of the future.

The rapid growth of the system made it advisable last spring to reinforce the 8½ × 10 engine running 350 revolutions, and the 14½ × 13, speeded to 250 to 265, by a second machine of the latter size, with its accompanying 800-light dynamos. Closely following this came an increase of the boiler capacity of the station last summer. After careful consideration this was accomplished by the placing of a 125 horse-power steel tubular boiler by the Jarvis Engineering Company. This course was pursued because of the following unfavourable points developed by the two Babcock and Wilcox sectional boilers of 73 horse-power each, which were first supplied:—

1. Slow action in raising steam. The tubular now in use shows 80 lbs. (from cold water) from 20 minutes to half an hour sooner than the sectional.

2. Difficulty in recovering pressure when started downward by a sudden increase of load. This probably results from the extremely limited steam room, and small body of water exposed to the fire. Where, as in electric lighting, it is suicidal to stop the works during a run, this point becomes a vital one, especially when one man is charged with a variety of duties.

3. Uncertainty as to the level of the water. It has often happened that after opening the gauge-cocks the water fails to reappear for some time, and leaves the fireman in suspense as to the real state of the case. The steam is also less dry, and of course less effective than in tubular boilers.

4. Amount of care necessary. The frequent cleaning of the outside of the tubes by steam jet should be supplemented by periodical inspection of their interior, a task which, as the plugs which close them speedily rusted in, has become practically impossible in this station between the hours of shutting down in the morning and starting again towards night.

5. Greater economy of tubular form with Jarvis boiler setting. The tests made elsewhere, on which this judgment was based, were supplemented in December last by a very careful trial here, of which the following figures give the comparative results.

COMPARATIVE RESULTS.

COMPARATIVE RESULTS.	Steel tubular boiler and Jarvis furnace.	Babcock and Wilcox boilers.
Date of tests	Dec. 3, '84.	Dec. 5, '84
Duration of tests	16h. 7m.	16h. 5m.
Grate surface ... ... sq. ft.	36	42
Kind of fuel used	1 part soft coal, 3 pts. screenings.	Clear soft coal.
Average steam pressure ... ... lbs.	85·16	87·22
Average temperature of feed water °F.	209·16	208·38
Pounds of fuel, consumed, {200 lbs. wood figured = 100 lbs. soft coal} Screenings,	lbs. 2,250	
Soft coal ...	lbs. 850	3,800
Pounds of ashes and refuse... ...	400	285
Pounds of combustible	2,700	3,315
Per cent. of ashes and refuse ...	12·9	7·5
Pounds water evaporated under actual conditions	32,458	37,004
Equivalent evaporation from and at 212°	33,724	38,521
Pounds water evaporated per pound of coal under actual conditions	10·47	9·74
Pounds water evaporated per pound of coal from and at 212°	10·88	10·01
Pounds water evaporated per pound of combustible actual conditions ...	12·02	10·53
Pounds water evaporated per pound of combustible from and at 212°	12·49	10·96
*Cost of fuel consumed	$5.85	$8.56
Pounds water evaporated @ 212° for $1.00 worth of fuel	5,765	4,500
Economy shown by use of tubular boilers, Jarvis furnace and screening mixture	22 per cent.	
H.P. developed by indication of Armington & Sims engines at comparative times. 5 p.m	96 H.P.	94 H.P.
6 „	96 „	105 „
7 „	92 „	92 „
{From 9 p.m. until 7 a.m. the power varied, being at times as low as 10 H.P.} 8 „	104 „	112 „
9 „	104 „	128 „
Factor of evaporation	1·039	1·041

* Cost of coal, {Soft coal, $5.05 per 2,240 lbs.
Screenings, $3.50 per 2,000 lbs.}

Practical points of interest.

The central station system shows in practice all the advantages of isolated plants with one or two important additional features. The steadiness of the light should in most cases be far superior, while the presence of duplicate boiler, engine and dynamo power guards against the liability of interruption which exists in isolated installations.

It may not be out of place in closing this already long communication, to suggest a few points of importance to syndicates or individuals thinking of starting stations this year.

1. The choice between the overhead and underground plans should be determined by the feeling of the people regarding heavy pole lines in or near the principal streets, the existence of present lines or rows of trees, the feasibility of placing poles on private land along the rear lines of street lots, and the prospective size of the system. Very few cities can be adequately served by overhead systems. Housetops should be avoided, and poles, when used, should be only from 90 to 110 feet apart, for heavy lines carrying feeders. The overhead conductors, if adapted to the place, will cost from one quarter to one-third as much as the underground.

2. If you contemplate an underground system, come to Brockton if possible, and study the results where present knowledge has been gained largely by home experience. If an overhead installation is to be preferred, visit the plants in Pennsylvania or Ohio.

3. If an experienced manager is not available, secure during construction and the early month or two of operation, the best practical knowledge of the three-wire system which money will furnish. Don't make the mistake of attempting to cut running expenses the first year by using men of questionable ability. No well-informed Edison man is disposed, as Mr. Edison has well expressed it, "to make mysteries of plain things," but no Edison station will run itself and earn an enviable name. The care and judgment exercised in manipulating the station machinery, the meters and the lamps, are of paramount importance to the early reliability of the service and its lasting reputation. When numbers of good men have become familiar with the system, it will be time to choose between them. Get the best while the first few months' service is moulding public opinion.

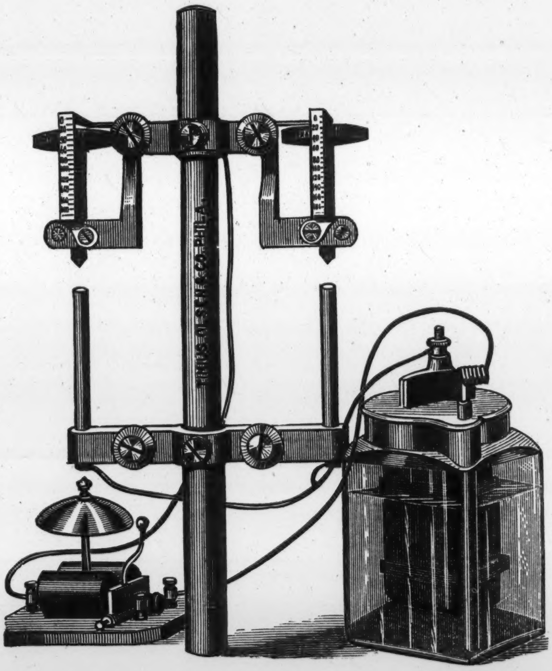
4. If possible, combine the arc and incandescent systems under one management and one roof. One steam plant and one force of men can care for both, and no better training for the handling of the dangerous high tension currents can be found than that which teaches the proper care of low tension conductors. If there is money to be made in electric lighting, it is to be found in a system where an arc lamp like the Thomson-Houston lights the street, and the Edison glows from the show windows, while the same fires make steam for both, or the same turbine moves the common shaft.

5. One cardinal idea should be borne in mind in the work of construction. Selling lights by electric methods is, in effect, selling distributed power. Hence the first cost of power and the loss of it in transmission are most important factors in the grand result. It has been shown how the management of the Brockton station has succeeded in reducing the cost of their coal and increasing the efficiency of their steam plant. In the distribution of the current the principle enunciated by Sir William Thomson and others that "the additional running expense due to the resistance of conductors should equal the interest on their first cost" applies with certain modifications to the Edison system, and experience has shown what form those modifications should take.

6. Don't allow the spring to pass before your plans for this year are well outlined and in process of execution. The American capitalist, unlike his more moderate English cousin, is impatient for immediate dividends, and the results of the first year's run seem abnormally important to him. If a good showing is to be made for the year ending July 31st, 1886, there is no time to be lost in getting started, for the land should be bought, conductors figured, made and laid, station built and equipped, and a good number of lamps wired for before the 1st day of August. Starting then, the machinery will be worked down to smooth bearings, the public convinced of the reliability and other merits of the light, and several hundred lamps connected by September 1st, when the harvest time of the incandescent plant commences. By April 1st of next year, if good judgment has prevailed and success has smiled, the list will be large enough to carry the expenses through the short hours of summer lighting, and the Edison system be shown to be a practical success with its patrons from the outset, and likely to insure a commercial return to its stockholders within a reasonable period.

ELECTRIC MEASURING APPARATUS.*

EXACT measurement plays such an important part in modern engineering that a ready means of accomplishing results rapidly is essential to the practical application of an apparatus designed for that purpose. The laboratory, with its cathetometers, microscopes, revolving mirrors and standard rules and bars, affords ample means of exact measurement, but for practical purposes the screw still occupies the field where minute variations are to be rapidly noted. The point to be observed in its use, however, consists in bringing the screw to bear upon the object with the same pressure at each successive measurement. Various devices have been used for this purpose, among them the interposition of a spring; but one of the most simple and effective is that which calls in electricity as an aid.


TINIUS OLSEN & CO. PHILA.

Our illustration shows the manner in which the latter is applied in determining the varying dimensions of a test piece subjected to stress in a testing machine. The central bar, representing the piece to be tested, has two clamps screwed to it, the distance apart of the clamping points being equal to the length which it is required to test. The upper clamp, as shown, carries two micrometer screws with graduated heads and vertical rule, while the lower clamp carries two uprights which rise opposite the micrometers. The upright bars are insulated by bushings of insulating material, so that no current can enter them from the test piece. Their lower ends, however, have wires attached to them, which are united and attached to one pole of the battery. The other pole of the battery is connected by wire to an electric bell, and thence to the upper clamp. In the position shown, the circuit is open, but when it is desired to take a measurement the micrometer is brought down to its pin, and the moment contact is made the bell rings. As it requires only the most minute contact to close an electric circuit, the method is evidently a very delicate one, and pressure may be said to be entirely eliminated, thus making each measurement exactly similar in condition.

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* *Electrical World.*

It is evident that this method of measurement may with advantage be applied to other purposes. It combines accuracy with rapidity, and with little practice the point of contact can be ascertained at the first turn of the screw.

This machine is exhibited at the New Orleans Exposition by Messrs. Tinius, Olsen & Co., of Philadelphia, who show there in variety their admirable testing apparatus for use with all kinds of materials.

THE KAY ARC LAMP.

THE arc lamp of Mr. Thomas L. Kay, of Hamilton, Canada, is a lamp novel in its action and simple in its mechanism. The principle of its operation is the differential action of two solenoids upon an iron core.

Fig. 1 is an elevation of the lamp, and fig. 2 a section through the line *a*, *b*; fig. 3 is a section through a portion of fig. 1. We learn from our New York contemporary, the *Electrical Review*, that the feed magnet consists essentially of a hollow, cylindrical brass core, D, terminating in flanges at the ends. This core is large enough to permit the iron feed-rod, C, which is connected with the upper carbon, to move freely up and down within it. Around the core bobbin, D, is wound the coil, G, of coarse copper insulated wire, and over this is wrapped the insulating material, F^2. A coil of fine insulated copper wire, E, is now wound over all, but in an opposite direction to the coil of coarse wire. The outside end of the coil, G, is connected to the binding-post, I^2, and the inside end with the brush, R. This brush is in light contact with the feed-rod, C, and conveys the main current from the binding-post to the upper carbon. The inside end, O, of the coil, E, which is in a shunt from the main circuit, around the arc, is connected to the binding-post. I^2, and the outside wire, P, with the binding-post, K. One of the line wire terminals, L^1, is attached to the binding-post, K, and the other, L^2, to the post, I^2. The method of operation is obvious. The main current passes through the coil, G, magnetises the core and raises the rod, C, till the proper arc is established. Now, as the carbons burn away, the length, and with it the resistance of the arc increases, the current in the coil, G, decreases, and that in the fine coil, E, increases, and, as they are oppositely wound, the one tends to counteract the magnetic action of the other—at length the carbons reach the limit of proper separation, when the resistance of the arc is so great as to so proportion the currents in the two coils, that their magnetic effects equally balance, and the rod being released falls again to the proper arc when the original action of the coils is resumed.

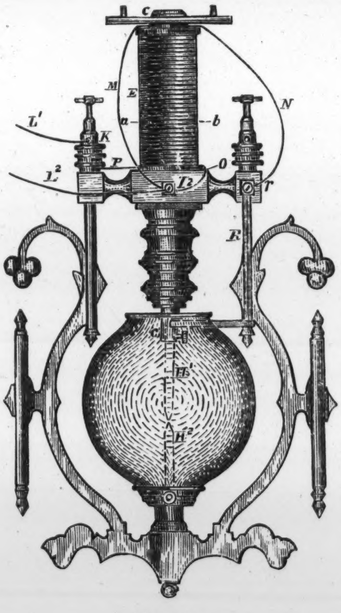


FIG. 1.

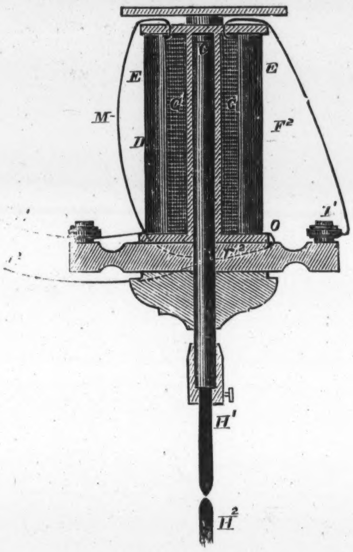


FIG. 2.

This lamp is of very tasteful design, and so arranged as to cast but little shadow. It is manufactured in Hamilton, Ont.

THE AMPÈREMETER OF M. HESEHUS.

AN ampèremeter, based upon Peltier's phenomenon, has been recently constructed by M. Hesehus. It consists of a differential air-thermometer into the two reservoirs of which are introduced the ends of wires of iron and nickel-silver, soldered together.

If an electric current is conducted through these wires the series of solderings in one of the reservoirs is heated and the other series is refrigerated, since on the one side the current passes from the iron to the nickel-silver, and on the other in the opposite direction. This change of temperature produces a change of atmospheric pressure in the two reservoirs and consequently a displacement of the liquid in the manometer which connects them together. This displacement is proportional to the intensity of the current.

The accompanying figure explains the arrangement of the apparatus. Twelve wires of iron and nickel-silver are fixed in two round stoppers and soldered together so as to form a thermo-electric battery.

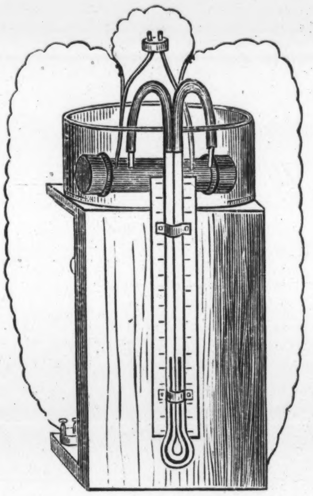
Besides, there are four ends of free wires, two of which form the conduction of the current, while the two others are fixed together.

The two stoppers are fixed hermetically in two small glasses, which form the reservoirs of the air-thermometer. Through these stoppers pass four glass tubes, bent at right angles, two of which connect the two reservoirs with the manometer by means of caoutchouc tubes, whilst the two others (which may also be closed hermetically) communicate with the air. The U-shaped manometer is half filled with petroleum.

The air arrives in the reservoirs by means of the two small glass tubes, which—as well as the reservoirs—may be hermetically closed during the experiment. The two reservoirs of the thermometer are in a vessel filled with water, in consequence of which the liquid of the manometer is more quickly brought to an equilibrium.

To prove the practical value of the apparatus, M. Hesehus gives certain measurements made with this instrument which show that Peltier's phenomenon is proportional to the intensity of the current.

A Grenet element gives an elongation of 4 mm. if a given unit of resistance is inserted, and with two such units 1·3 mm.



Six Baudet elements give an elongation of 6 mm.; 6 elements with double the surface, 11 mm. A gramme machine gave an elongation of from 10 to 20 mm.

M. Hesehus claims for his apparatus, says *La Lumière Electrique*, the following advantages :—

1. It indicates the intensity of the current at each moment and not, like ordinary voltameters, the mean only.

2. It is simple and cheap and may be employed in the neighbourhood of a dynamo machine, as it does not contain a magnet.

3. It renders possible the measurement of alternating currents as well as that of continuous ones, and it may serve both as a galvanometer and as a dynamometer.

THE ARRANGEMENT FOR ELECTRIC LIGHTING IN THE ARCADE HOUSES OF THE UNION BUILDING COMPANY AT THE PARADE PLATZ, VIENNA.

THE electric lighting installation which has been fitted up in the houses belonging to the Union Building Company, near the new Town Hall, serves for lighting up the rooms of the café and the restaurant on these premises, for the arcades, and also for a private house.

The machines and steam boilers for working the installation are in the sunk storey of the house I., Ebendorfer strasse 6, and include :—

Three boilers, with smoke consuming furnaces, on the Ten Brink system, consisting of one steam collector, three upper boilers, six lower boilers, and one Ten Brink ante-boiler. They have a pressure of six atmospheres, and a heating surface of 63 square metres each. One of these boilers is for the electric light, one serves in winter to heat the building by means of steam pipes, whilst the third is a reserve. The steam engine is a high-pressure horizontal, with Corliss gearing, the diameter of the cylinder is 370 millimetres, the stroke 790 millimetres, and making 69 revolutions per minute.

The dynamos are impelled by a countershaft connected by the engine with a hemp driving band.

For the glow lights there are used four Edison machines, each for 60 lamps of 16 candle-power, or 120 at eight normal candles.

These machines supply 142 B lamps at eight normal candles, and 37 A lamps at 16 candles for the café, 188 B lamps for the restaurant, about 60 B lamps in a private residence, and 13 A lamps in the machine and boiler house, making together 490 B lamps, all the lamps being reduced to the B standard. The machines make 1,200 turns per minute. The glow lamps are all Edison's. For the six arc lamps which light up the arcades two Gramme machines are in use, one of which supplies two lamps at 1,000 normal candles, and the other four lamps at 1,000 normal candles.

The former makes about 850 turns, and the latter 1,300 turns per minute. The power expended for the normal working of the entire installation is 52 horsepower.

The café has been lighted without interruption since May 15th, 1883, and the restaurant since April 3rd, 1885. The steam boilers and engine were supplied by the firm of E. Skoda, of Pilsen. The entire installation has been carried out by Brückser, Ross & Co.

On April 17th the engineer, J. Kolbe, explained the arrangements in fullest detail to his pupils from the Technological Trade Museum. The installation has worked faultlessly from the very beginning.—*Zeitschrift für Elektrotechnik.*

ELECTRIC DISCHARGE OF ARTILLERY ON BOARD OF MEN-OF-WAR.

By M. BURSTYN, Imperial and Royal Marine Electrotechnicist.

THIS arrangement, the joint invention of Captain E. von Wohlgemuth and Siegfried Marcus, is thus described in a German technical journal.

The ignition of the cannons is effected by means of split primers. These are primers in which the priming is arranged around two wires which, in the ∩-shaped curve, are separated from each other by a space about $\frac{1}{10}$th of a millimetre in width. The electric current intended for ignition must have such a tension that, overcoming the resistance of the space, it may spring over in the form of a spark from one wire to the other, ignite the priming and thus fire off the cannon.

An essential constituent of this system of discharging artillery is the cell inductor constructed by the Viennese mechanician Siegfried Marcus. It is shown in section in fig. 1, as seen from above in fig. 2, whilst fig. 3 shows its electrical construction.

As will be seen from the figures, it consists, like every inductor on Ruhmkorff's system, of a primary coil, I, of thick copper wire, wound on an iron core, F *e*. In its circuit is introduced a Neef's interrupter, H, S, and at both ends there is inserted in the ordinary manner a condenser, C, to cut short the course of the extra currents, and, consequently, to strengthen the inductive action.

Over the primary spiral are wrapped alongside of each other from four to seven secondary coils, *i.e.*, as many as there are guns on each broadside. In fig. 3, for greater simplicity, only two such secondary spirals, I, I, are shown with their ends, d, g, and d', g'. They lead to the binding screws, f, f', and f'' f''', into which are also fixed the conductors from the primers, Z, Z′.

From both the ends of the wires of each of the secondary spirals there are carried ramifications to the coatings of the small special condensers, C and C′. These become charged and in the moment of ignition they discharge themselves over the space, and thus render the spark much more powerful. The action of the condensers introduced into the secondary circuit is very important.

In general the discharge of the cannon will be clear without further explanation. At the moment when the primary current, coming from the battery, B, is closed by pressing down a key introduced into its circuit induced currents are set up which explode the primers introduced into their circuits, one for each gun. The discharge of all the guns of a broadside connected with the cell inductor can thus be effected simultaneously and at any desired moment.

Each broadside of the ship has its own independent arrangement for discharging its cannon. The batteries are fitted up in the hold. The conductors are led from them to the primary coil of the inductor through a key which is placed on the captain's bridge. Each broadside has its own primary conductor and its own key. For every gun there is a special secondary conductor leading to one of the secondary coils of the cell inductor. The discharge of all the guns of a broadside, or of those which are in connection, can thus be effected from the bridge. In the secondary circuits of each gun there are special bridge-boxes introduced, by which any one gun can, at will, be connected or disconnected, and which render it certain that no gun can be discharged prematurely or unintentionally.

The most essential advantages of the electric discharge of cannon are :—

1. Increased effect in consequence of the simultaneous impact of the projectiles.

2. Firing from the bridge where the ship is manœuvred renders it impossible to mistake friends for enemies.

3. Small corrections for distance can be made at the last moment by firing before or after the ship is "on an even keel," according to the direction of its rolling.

4. Improved discipline, *i.e.*, the choice of the moment for firing is removed from the captain of the gun, who cannot see distinctly in the smoky gun-rooms.

5. The option of discharging the guns singly or all together.

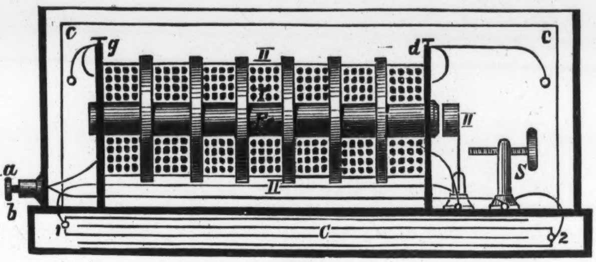


FIG. 1.

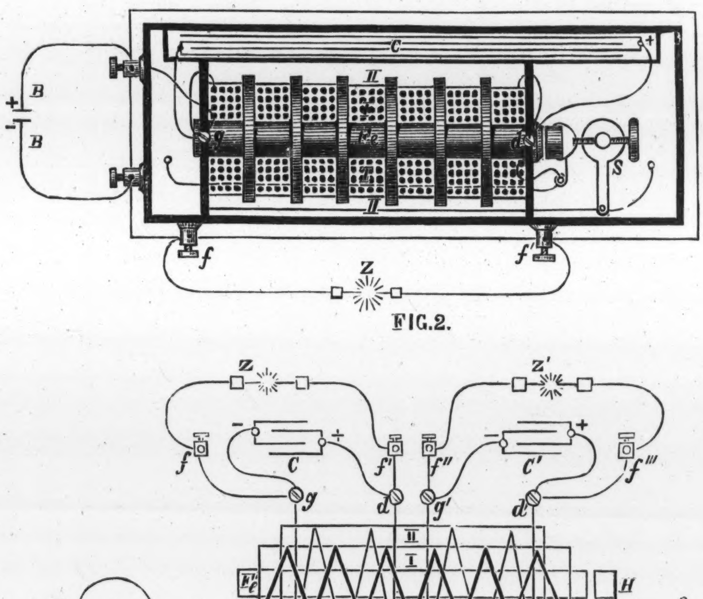


FIG. 2.

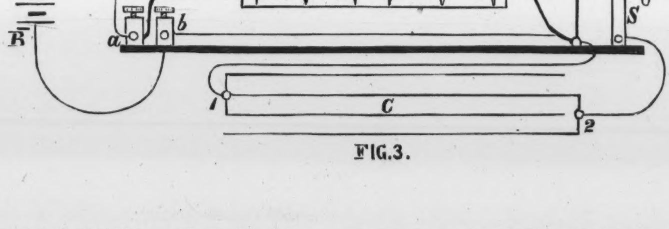


FIG. 3.

THE REGULATION OF SPEED OF ELECTRO-MOTORS.

By M. MARCEL DEPREZ.

I demonstrated more than four years ago that dynamo machines may satisfy either the condition of maintaining a constant difference of potential between two conductors from which there branch off a variable number of derivations, or that of producing a constant current in a circuit, the resistance of which equally varies from one instant to another, and that for this purpose it is sufficient to fit their inductors with two distinct coils traversed in the same direction, the one by a constant current and the other which varies automatically, according to the number of apparatus supplied, without the intervention of any mechanism. In the case when these apparatus are placed in derivation the variable current is simply the total current equal to the sum of the partial currents which traverse each of them, and the constant current which passes through the second coil may be taken either from an external source or from the machine itself, since the difference of potential is constant.

Among the consequences of the method which enabled me to discover this process of regulation by means of a double coil—a process which is now applied by a number of constructors under the name of "compound machine"—there is one which I pointed out more particularly, that is that this process of regulation acts only on condition that the velocity of the machine has a given value on this side of, and beyond which the difference of potential becomes variable with the number of derivations. Experiment has fully confirmed these theoretical deductions.

It is interesting to study what takes place in a machine of this kind if we reverse its functions, that is, if we pass a current into the ring, keeping the difference of potential constant at the extremities of the machine, which then becomes the recipient instead of the generator.

It is easy to ascertain that, in this case, the currents which traverse each of the coils of the machine are in opposite directions, whilst they are in the same direction when the machine acts as generator. The magnetisation of the inductors is then due to the difference of these actions instead of being due to their sum.

If we place the two extremities of the machine in connection with a source of electricity capable of maintaining the difference of potential constant the machine is traversed by two currents, the one passing through the ring, as well as the coil connected with it, which I will call coil A, and the other current traversing the coil B. This latter current will be constant, the former, on the contrary, will have its maximum value when the ring is immovable, and, consequently, developes no electromotive force, and it takes a value smaller and smaller as the speed of the ring goes on increasing.

There is even a velocity of the ring at which the electromotive force which it developes exactly counterbalances the difference of potential at the ends of the machine; in this case it is no longer traversed by any current, the coil A becomes inactive and the magnetic field is entirely due to the action of the current which traverses the coil B.

The motor effort exerted upon the ring is proportional to the product of the strength of the current which traverses it, by that of the magnetic field in which it revolves. It is, therefore, null in the case which we have just been considering, but if we apply to the ring, an effort in the contrary direction to its movement, its speed diminishes progressively, the electromotive force which it developes diminishes also and becomes inferior to the difference of potential at the ends of the machine; hence it follows that the ring, as well as the coil A, is traversed by a current. As for the intensity of the magnetic field it is easy to see that it must diminish, since the coil A acts in an opposite direction to the coil B.

The product of the intensity of the field by that of the current which traverses the ring is therefore no longer $= 0$ as in the former case. To sum up, the decrease of the speed of the ring below that for which it developes an electromotive force equal and opposite to the difference of potential at the ends, will have the result of developing a mechanical effort.

It may appear singular, at first sight, that we increase the motive effort by diminishing the intensity of the magnetic field; the following considerations, which may be applied to any magneto-electric machine whatever, will show clearly the reason of this apparent anomaly.

We will call, ε, the difference of potential at the brushes of any machine whatever, turning in an independent magnetic field; E the electromotive force; R the total resistance comprised between the ends; I the strength of the total current.

The machine being a recipient, we have

$$I = \frac{\varepsilon - E}{R}.$$

The motor work developed in the unit of time may be expressed by

$$E\,I, \text{ or } \frac{E\,(\varepsilon - E)}{R}.$$

If we suppose the speed constant the inverse electromotive force, E, is proportional to the intensity of the magnetic field and the mechanical effort developed is itself proportional to the product $E\,(\varepsilon - E)$. But this product is null for $E = \varepsilon$ and for $E = 0$. It increases from zero up to its maximum $\frac{\varepsilon^2}{4}$, when E decreases from ε to $\frac{\varepsilon}{2}$.

The electromotive forces being proportional to the intensities of the magnetic field we see that it is sufficient to vary this from its maximum value (which corresponds to the case when the ring developes an electromotive force $= \varepsilon$) to the half of this value in order that the electro-motor may develop an effort, increasing from zero to the maximum which it can attain.

I shall give in a future communication, the exact solution of the questions pertaining to the use of the double coiled machine (compound machine) as a recipient, and I will give a geometrical construction permitting the determination of the conditions which it must fulfil in order that its speed may be distinctly independent of the variations of the mechanical work demanded.—*Comptes Rendus.*

SELF-INDUCTION.

IN the REVIEW for July 5th and August 2nd, 1884, we published a fully illustrated paper by Mr. Willoughby Smith, on "Volta and Magneto-Electric Induction." His concluding remarks were to the effect that as the values of some of the units which were adopted at the Electrical Congress in Paris were determined by passing masses of metal at varying velocities through a magnetic field of uniform intensity, and as these values did not in some instances agree, sufficient attention had not been given to the influence of a sluggish inductive effect, or retardation, to which Mr. Smith gave the name of "drag." Lord Rayleigh has taken this matter up, in our contemporary, *Nature*, from which we extract the following:—

"In a lecture delivered by Mr. Willoughby Smith before the Royal Institution in June last some experiments are detailed, which are considered to afford an explanation of discrepancies in the results of various investigators relating to the ohm, or absolute unit of electrical resistance. As having given more attention than probably anyone else in recent years to this subject, I should like to make a few remarks upon Mr. Willoughby Smith's views, which naturally carry weight corresponding to the good service done by the author in this branch of science.

"In the first series of experiments a primary circuit is arranged in connection with a battery and interrupter, and a secondary circuit in connection with a galvanometer and commutator of such a character that the make and break induced currents pass in the same direction through the instrument. Under these circumstances it is found that at high speeds the insertion of a copper plate between the primary and secondary spirals entails a notable diminution in the galvanometer deflection, and this result is regarded as an indication that the molecules of copper need to be polarised by the lines of force—an operation for which there is not time at the higher speeds. The orthodox explanation of the experiment would be that currents are developed by induction in the copper sheet, which thus screens the secondary spiral from the action of the primary, and the result is exactly what might have been anticipated from known electrical principles. I have the less hesitation in saying this, because as a matter of fact I did anticipate from theory the action of a combination very similar in character. The experiment is described in the *Philosophical Magazine* for May, 1882, and differs from Mr. W. Smith's only in the substitution of a telephone for the galvanometer, and of a microphone for the interrupter, no reverser in the secondary circuit being required. By the interposition of a thick copper sheet the sound is greatly enfeebled.

"The second series of experiments were made with Faraday's 'new magneto-electric machine,' in which a copper disc rotates about its centre between the poles of a horse-shoe magnet. The currents developed are examined with a galvanometer whose electrodes touch two points upon the disc—in Mr. W. Smith's experiments, one at the centre, and the other at the circumference. At low speeds the distribution is symmetrical with respect to that diameter of the disc which is passing at any moment between the poles; but, as the speed is increased, a certain 'drag' is observed, disturbing the symmetry. This drag, or lagging, was noticed by Nobili in a very similar arrangement as long ago as 1833 ('Wiedemann's Electricity,' third edition, vol. iv., sec. 374), and is no doubt to be attributed to the induction of the currents upon themselves.

"This question of self-induction is indeed a very important one in respect of certain methods for determining the ohm; but it certainly cannot be said to have been neglected, as Mr. W. Smith seems to suggest. Both in the original experiments of the British Association Committee with a coil revolving about a vertical axis, and in my own recent repetition of them, the self-induction of the coil is a most important feature, and may cause a displacement of the position of maximum current from the plane of the magnetic meridian through as much as 20°. In my paper (*Phil. Trans.*, 1882, p. 661) I thought I had discussed the question at almost tedious length.

"It is possible that Mr. W. Smith had in his mind rather determinations by the method of Lorenz, in which Faraday's disc is used. The arrangement here, however, differs in one very important respect from that of Mr. W. Smith's experiments in that the lines of force are symmetrically arranged in relation to the axis of rotation. The consequence is that, however great the speed of rotation, there are no currents circulating in the disc, and therefore no question arises as to the self-induction of such currents. What is observed is simply the difference of electrical potential between the centre and the circumference. It is impossible to discuss the matter fully here, but the reader will find all that is necessary by way of explanation in the paper published in the *Phil. Trans.* ('Experiments by the Method of Lorenz for the further Determination of the Absolute Value of the British Association Unit of Resistance,' &c.). My object in writing is to correct the inference, suggested by W. Smith's remarks, that the question of self-induction has been neglected by workers upon this subject."

DOMESTIC ELECTRIC LIGHTING.

WHEN several members of a family have their respective houses on the same plot of ground, and when one at least of such domiciles contains internal decorations which are of such an elaborate and costly description as to require careful tending, it becomes a matter of but little consideration to decide that the best method of illumination for such a class of residence is that of electric lighting.

Westwood House, Sydenham, the residence of Henry Littleton, Esq., the principal of the well-known music publishing firm of Novello, Ewer & Co., has recently been almost entirely rebuilt from designs by J. L. Pearson, Esq., R.A. The *Building News* of December 24th, 1880, speaks of this as a fine example of Renaissance design, and the *Times* of July 5th of the same year says: "This appears to us to be one of the most beautifully and thoughtfully designed houses of the year." It is a good sized mansion, in red brick, with tiled roof and external decoration presumably in terra-cotta, and is in reality the recasting of an old house with considerable additions. This rebuilding has been excellently carried out by Messrs. Veitch and Close, and in the matter of workmanship the house may be favourably compared with the very best productions of modern times.

Westwood House and two smaller houses occupied respectively by Messrs. Augustus and Alfred Littleton, stand in grounds of about nine acres in extent, and towards the latter end of last year Mr. Littleton finally decided to adopt the electric light, placing the arrangements for illumination entirely in the hands of his son.

The superintendence of the whole installation, which we will now briefly describe, has been most ably carried out by Mr. Augustus Littleton, the only professional assistance rendered being either the verification or modification of his preconceived ideas with reference to the selection of engine, dynamo, lamps, secondary batteries, and main conductors.

The prime mover is one of the "Otto" 8 horse-power (nominal) gas engines, running a few hours a day for charging accumulators, and supplied with gas from the same source as that employed by Professor W. G. Adams for his tests of the engines shown at the Crystal Palace Electrical Exhibition of 1881-1882. Here is also fixed a little instrument devised by the Electrical Power Storage Company for cutting out or again putting into circuit the accumulators. The dynamo is a shunt-wound "Phœnix," of Paterson and Cooper's manufacture, giving at its normal speed 110 volts and about 50 ampères. To ensure greater steadiness in its running, it has a heavy fly wheel attached to the armature spindle, and it is driven by a belt from the flyweel of the engine, both this and the dynamo being compactly fixed in a portion of the coach-house.

The accumulator-room is a spare loose horse-box, well suited for the purpose. Here are placed 100 glass cells, 1½-H.P. type, of the Electrical Power Storage Company's secondary batteries, with the latest improvements, and coupled up in twos. An instrument board contains two of Paterson and Cooper's ampèremeters, one reading to 25 and the other to 150 ampères; a Cardew voltmeter, registering 150 volts; and a switch for reducing the number of cells by two's from 50 to 42, or to cut them all out of circuit. The accumulator discharge leads are carried to a 3-way dividing piece, one for each house, which all make use of the same electromotive force for the lamps. In this room the E.M.F. and current of the machine may be tested, also the E.M.F. of accumulators and main discharge current, together with the initial E.M.F. and current for each house.

The lamps used are made by Messrs. Woodhouse and Rawson, and are chiefly of 20 candle-power, taking an E.M.F. of 95 volts, with a current of about 0·55 ampères each. There are, however, a number of 10 candle-power lamps connected up two in series. The main cables are the well-known Berthoud-Borel conductors, sheathed with lead tubing, laid in a wooden trough tarred inside and out, and filled with dry sand. The lengths are as follows:—From the accumulator room to the extreme of Westwood House, 90 yards; from the same point to Westwood Field, Mr. Aug. Littleton's residence, 270 yards; and to Mr. Alfred Littleton's, 100 yards; the cables being so proportioned that the fall of potential is the same to each house.

The operations of fixing the lamps, wiring the houses, laying the main cables, and generally carrying out the work connected with the installation, was undertaken by Messrs. Paterson and Cooper, and this has been completed to the entire satisfaction of Mr. Littleton.

The various switches, fusible plugs and measuring instruments, are from the same firm, but Messrs.

Faraday & Son have supplied all the fittings for Mr. Augustus Littleton's rooms, and Messrs. Barkentin and Krahl, of Regent Street, have designed very original and unique fittings in hammered copper and iron for Westwood House.

In various rooms wall fittings have been placed for the insertion of portable lamps, which may also be used as table lamps. The wiring of the large house involved a considerable amount of care and trouble, as the architect's instructions were to the effect that in no place should a wire be visible. The two small houses are lighted throughout with about 70 lamps each, and Westwood House will contain more than double that number, and including those for a small theatre, the total will be nearly 400 lights.

The whole installation will be in charge of a youth of about 18 years of age, who will, however, spend but half his time in this work.

We cannot yet give any particulars as to the working cost of the plant, but we understand that Mr A. Littleton is carefully preparing a statement of the expenses entailed thereby.

That which strikes us as being most worthy of remark in connection with this matter, is the fact that it has been entirely superintended by a private individual. We are aware that for some years past Mr. Augustus Littleton has kept himself well abreast of the advance of electrical science, but nevertheless we think that the work he has just carried out would have done credit to any professed electrician.

We may add that since, the beginning of January, when a portion of the lamps were first put into use, no hitch of any kind has occurred, and we think that the entire installation may be pronounced eminently successful; so much so, indeed, that we shall be surprised if many other private gentlemen with similar means at command do not follow such an example.

THE REPORT OF THE COMMITTEE ON TELEPHONES AND TELEGRAPHS.

HAVING held eight sittings for the reception of evidence and examined twenty-nine witnesses, the Select Committee upon the subject of Telephone and Telegraph Wires have presented their Report. Mr. George Russell, the chairman, submitted a draft report, but this was materially altered by the committee, and in the end it was adopted in the following form:—

"Your committee have heard evidence from the Post Office, the telephone companies, the various local authorities of the metropolis, the corporations of some of the leading provincial towns, and private owners and occupiers.

"After careful consideration of this evidence, your committee have come to the conclusion that the risk of danger to the public from overhead wires has been very greatly exaggerated.

"The accidents which have been proved in evidence have been few and insignificant. In the most important instance the fatal result was due, not to the breaking of the telegraph wire, but to a well-meant attempt by a member of the public to replace it.

"At the same time, your committee are of opinion that the probable development of the telephonic system makes it desirable that there should be some change in the law relating to control over wires, with a view to their better supervision.

"The present state of the law is, briefly, this:—

"The Postmaster-General works under the powers of the Telegraph Acts, 1863 to 1878. The Acts of 1863 and 1878 give the powers. The Act of 1869 gives the Postmaster-General his monopoly. The Act of 1868 gives certain powers respecting railways. The powers may be conveniently divided thus:—

"1. *Overground Along Roads.*—Consent of road authority first to be obtained. If refused there is an appeal to a stipendiary magistrate or to a county court judge, and a further appeal by either party to the Railway Commissioners. Permission having been obtained, the Postmaster-General:—(1.) *In towns* proceeds without further consents, but subject to various limitations, including a provision that he must not place a post within 10 yards of a dwelling house without consent of occupier. (2.) *In country* he has to obtain various other consents of adjoining owners, to publish notices, &c., with appeals against refusal, &c., and to take other proceedings involving possible long delays. There is also a similar provision against placing a pole within 10 yards of a dwelling house without consent of occupier, as in towns.

"2. *Underground Along Roads.*—(1.) *In country* the Postmaster-General can proceed, subject to certain notices and regulations, without any consent. (2.) *In towns* he must obtain the consent of the road authority, with appeals against refusal as above, and then he can proceed, subject to notices and regulations.

"3. *Overground by Attachments to Property.*—The Postmaster-General has no powers except in towns; where, having obtained consent of road authority, he may pass wires over buildings or lands (not being building land or gardens or pleasure grounds) adjoining or near to the street, subject to notices and restrictions. He has no power of making attachments to private property.

"These powers are inherited from the telegraph companies, the right of appeal against a refusal by the road authority or by a private owner being given by the Act of 1878. Neither the telephone companies nor any other persons or companies have any statutory powers. They carry on their business only as licensees of the Postmaster-General, and are governed merely by the general law. They have no power to make attachments to or to run wires over private property. It has, however, been decided by the Court of Appeal that the road authority has no power to interfere with wires passing over roads unless they interfere with the user of the road, or are a source of danger.

"Certain corporations have recently obtained local Acts, giving them authority to deal with wires. From all these (10 in number) the Postmaster-General is excepted. In two cases (Nottingham and Chester) the local authority has an absolute veto on overground or underground wires in or over streets. In four cases (Heywood, Dewsbury, West Derby, and Bolton), there is an appeal from this veto to a court of summary jurisdiction. In four cases (Liverpool, Manchester, Birkenhead, and Croydon), the corporation may make bye-laws on the subject, which must, however, be approved by the Board of Trade. Two distinct principles are involved in these Acts:

"(*a.*) *In Heywood, &c.*—It is a *judicial* question. The question is between the local authority and the company erecting the wires, and disputes are referred to the county court judge.

"(*b.*) *In Liverpool, &c.*—It is an *administrative* question. Byelaws for the regulation of the wires are made, and the local authority administers them.

"Having regard to this state of the law, and to the necessity for some alterations in it, your committee would submit the following suggestions:—

"Regarding the free development and use of the telephonic system as essential to the public convenience, your committee cannot recommend any course which would materially hamper its extension. The system of public telephone exchanges, whereby persons at considerable distances apart may converse freely the one with the other, is a great public convenience. The number of subscribers to these exchanges is already over 12,000; the number of messages sent during the year was over 41,000,000; and the average cost per message was less than one penny. This system is daily growing, now that increased facilities have been given for the purpose by the Postmaster-General. In London alone the number of subscribers is nearly 4,000; but the capability of development may be estimated by the fact that according to the evidence of Mr. Preece (electrician to the Post Office), there are more subscribers to the telephone system in New York and its neighbourhood than in the whole United Kingdom, notwithstanding that the charge in New York is about double what it is here. The annual number of messages in London is over 15,000,000.

"The companies have recently proposed to place every post office in the London district upon their exchange system, upon any reasonable terms to which the Postmaster-General may agree, so as to afford the entire public of London the means of instantly conversing with subscribers to the system, and similar offers have been made by other companies for towns in their districts; and the committee therefore recommend that the erection of overhead wires should be continued, subject to proper regulation and supervision.

"In order to obviate the delays and difficulties experienced by the Post Office in laying down wires, especially along roads, it is proposed that the Postmaster-General should be authorised to give notice of the intention to erect any telegraphic line, before, if he thinks fit, instead of after, obtaining the consent of the road authority. Such notice to be advertised and posted in the street affected in towns, and in the country to be also left (as at present) at any dwelling house within 50 feet of the road, and to be served on the occupier of any park or pleasure ground.

"All persons (including the road authority) desiring to object to the mode in which the proposed line is to be carried, should send in their objections to the Postmaster-General within a stated period (say three weeks), and all objections not so sent in should be barred.

"All objections so made should be referred to a competent tribunal, which should be empowered to make an order authorising the erection of the line on such conditions as may be deemed just, and to make such order as it may think fit as to the costs occasioned by the several objections.

"This tribunal might conveniently be the county court judge (sitting as an arbitrator) of the district within which the property in respect of which the objection is made is situate. The county court judge should be substituted for the police magistrate, where the jurisdiction is given at present to the latter tribunal.

"If an appeal from the county court judge is thought necessary, this might properly lie to the Railway Commissioners, as at present; but the Postmaster-General should be authorised to proceed with the erection of his line if the appeal to the Railway Commissioners is not prosecuted within a fixed period (say one month) of the decision of the county court judge.

"The Postmaster-General should be allowed to make attachments to private property with the consent of the occupier, and should not be obliged, as at present, to obtain the consent of the lessee and owner, subject, however, to the condition that consent of the occupier held good during the term of his occupation only.

"The provisions of the existing Acts inconsistent with the foregoing suggestions should be repealed, and especially the provision requiring the Postmaster-General to obtain the consent of the occupier of every dwelling-house within 30 feet of a pole.

"The telephone companies occupy a position somewhat similar to that occupied by the old telegraph companies, save that they are acting under the license of the Postmaster-General, to whom they pay a large royalty, estimated at present at the rate of £20,000 a year, and liberty to increase if they are given reasonable facilities for the service of the public. It is proposed by the representatives of the Post Office, and your committee recommend, that the licenses of the Post Office should have the same powers with regard to the running of their wires as the Postmaster-General; subject however, to the proviso that the wires of the company should not be permitted to interfere with those required for the general public telegraphic service by the Postmaster-General.

"Your committee are of opinion that, under proper regulations, permission should be given to pass wires over property without the owners or occupiers having the right of prohibition; but this facility should confer upon those enjoying it no vested interest or easement, and should not relieve them from any claim for damage occasioned by them.

"They should be required to remove or alter their wires if the premises were about to be raised, or for any other good cause shown; and the occupier should be given an appeal to the local authority to order the removal of the wire, in case he could show special circumstances which caused the same to be an injury to him or to his property.

"With regard to attachments; these can only now be made either by the Postmaster-General or by any person else, with the consent of the occupier and owner. In certain cases it may happen that it is impossible to obtain access to premises for the purpose of connecting them with the general public telephonic system, owing to the refusal of an individual to permit an attachment.

"It was given in evidence that many of the inhabitants of the Inner Temple are desirous of being connected with the telephone exchange, but that the telephone company is unable to obtain permission to run wires for them. It was also given in evidence that a similar prohibition has been exercised in the case of Covent Garden.

"Your committee think that in special cases, where it could be proved to the satisfaction of the local authority on investigating the whole circumstances, that certain individuals or certain districts were debarred from the public convenience of telephonic communication owing to such refusal, the local authority should be authorised to give permission to attach wires to premises under suitable regulations and on payment of such compensation as the local authority might think just.

"Bye-laws for the regulation of all wires, as to substance, length of span, durability, and other matters, and for their identification and inspection, should be made for the whole of London by the Metropolitan Board of Works, for provincial towns by the corporation, for rural districts by the local authority, in each case subject to the sanction of the Board of Trade. In London the enforcement of these bye-laws should be entrusted to the Corporation of the City, and to the vestries and district boards.

"For the protection of the public it is necessary that there should be a ready means of dealing with every wire.

"For this purpose every wire should be identified, and the bye-laws should provide for the best method of identification, by registration or otherwise, and for the removal of all ownerless wires.

"Your committee believe that such regulations as they have recommended will be abundantly sufficient to protect the public from inconvenience and danger, however wide may be the extension of the telephonic system.

"At the same time they believe that nothing which they have recommended will impede the natural development of an invention the great and increasing utility of which they fully recognise."

Incandescent Lamp Tests at Philadelphia.—As we (*Electrical World*) go to press a New York morning paper announces in a telegram dated from Philadelphia, that "in the test as to the relative duration of the lamps of the various electrical companies the result thus far is as follows:—Lamps destroyed out of 20 at the end of 305 hours: Weston, 11; Stanley, 12; Woodhouse & Rawson, 10; Edison, 1." In the absence of any official statement or report, nothing definite can, as yet, be asserted, and the figures are to be accepted with reserve. Standing by themselves, the duration tests of the life of the lamps, however, tell but a partial story, and to judge by inference would, in this case, be manifestly unfair. We hope soon to be able to present the full figures to our readers, when legitimate comparison and full discussion will be in order. The duration test referred to is to last 600 hours, of which only about 400 have passed.

NOTES.

The Electric Light at Brighton.—It has been decided to discontinue the use of the electric light for ordinary purposes during the summer months at the Brighton Pavilion, and Mr. Volk, who has had charge of the arrangements, was instructed to give the driver of the electric light engine notice to terminate his engagement yesterday. A report on the subject was presented at a meeting of the Brighton Town Council last week, when Councillor Berry sensibly remarked that if there was one time more than another when the electric light would possibly be a benefit to the frequenters of the Pavilion it was in the summer, by allowing the place to keep so cool. Alderman Lamb stated that Mr. Volk had kindly offered to forego his salary whilst the electric light was not in use. The proceedings of the committee were carried.

Electric Lighting Accident.—An unfortunate accident occurred on the 22nd ult. at Messrs. Willoughby, Hill & Co., Chicago. A new plant, or rather a change of the former plant of Brush lights, was being installed, consisting of clusters of lights on lamp posts. The dynamo was running, and Mr. Charles B. Schultz, an expert, thoroughly competent, in the employ of the Western Electric Company, was adjusting one of the lamps which had gone out. Receiving a slight shock, he called for a stick with which to close the lamp switch. Having done this, by some unexplained method he apparently "got caught" again, when he grasped the frame of the lamp, which, swinging toward him, made him lose his balance. Schultz fell, crushing his skull, and producing instant death. The line was well insulated, the test made the next day showing over 1,000,000 ohms insulation resistance—a proof that the accident was not caused by ground leak, and the lamps were not extinguished until shut off by the engineer. The inquest, post-mortem, failed to show any definite proof of injury from electricity. The hands were unscorched, the internal organs intact, and only the watery condition of the blood was adduced as proof of possible death through a shock. The probability is—and this was about the finding of the jury—that he was partially paralysed by a shock which would not have proven fatal, and fell from inability to control his movements, the crushing of his skull producing death. —*Electrical Review*, New York.

The Electric Light in Stores.—The Cold Meat Stores of Messrs. Bell and Sons, which are being built in Charterhouse Street, will be fitted with the electric light. The contract has been given to the Electrical Power Storage Company, who carried out a similar installation some time back for the East and West India Dock Company, which has given every satisfaction.

The Kensington Subway Lighting.—In connection with the lighting of the subway from the railway station to the Inventions Exhibition, we are informed that Messrs. Goolden and Trotter have been temporarily supplying the current to the batteries of the Consolidated Company, whose dynamo was not ready for running. The current has been generated by their Halifax machine, which, being run at 12 per cent. above its normal capacity for sixteen hours daily, has proved its capabilities and the excellency of its manufacture.

The Electric Light in Ball-Rooms.—Electric lighting for balls and receptions appears to be rapidly becoming the fashion this season, and the Electrical Power Storage Company has been quite busy with this class of work. On Wednesday the 6th there were two installations at work on the same evening, one at Lady Mill's residence, carried out under the superintendence of Mr. F. G. Howard, and the other at Mr. Montagu's, in Kensington Palace Gardens, where the company fixed over 120 lamps of 20 candle-power.

The Lighting of Trains by Electricity.—An experiment, applied by the Lancashire and Yorkshire Railway Company to their fast service between Liverpool, Manchester, Leeds, Bradford, and York, was tried for the first time on Friday last week upon the train leaving Victoria Station, Manchester, for Yorkshire, at five o'clock, and, so far, the experiment has been even more successful than was contemplated. A small spherical "Tower" engine was placed on the side of the foot plate at the front of the powerful locomotive, and coupled to the dynamo. The whole apparatus occupies about four square feet of space, and it is under the direct control of the driver, for by turning a switch he can feed all the secondary batteries with which each carriage in the train is provided. A constant supply of electricity sufficient to light all the carriages can be generated in this way during the passage of the train, but since it is necessary to make a division at Sowerby and at Low Moor for the Leeds and Bradford portions it has been found most advantageous to charge the accumulators before starting. This can be done in about an hour by the small engine and dynamo while the train is waiting in the shed, and the supply thus generated is sufficient to light the train during the whole of the down and up journeys. The connection between the engine and the carriages is maintained by means of a system of very simple "slip catches," which can be connected and disconnected either by hand or by the slipping of the portions of the train without interfering with the light. The battery in each carriage—it is placed under the seat of one of the end compartments—is sufficient for the lighting of all the compartments, so that even if the train was broken or the engine stopped, the light would not be extinguished. Three wires run from end to end of the train on the roofs of the carriages, and the circuit is so arranged that the lamps may be burning at the same time as the secondary batteries are being charged by the dynamo, or the dynamo may be thrown out of circuit without affecting the lamps. On the other hand, the secondary batteries can be charged while the lamps are out of circuit. The switch for putting on and off the light is fixed in the guard's van. The lamps are 10-candle power, Woodhouse and Rawson's, and they form a pleasing contrast to the dirty oil vessels which they have supplanted. This experiment of the Lancashire and Yorkshire Railway has been carried out under the direction of Mr. Louis John Crossley, of Halifax, one of the directors of the company.

In the ELECTRICAL REVIEW for January 3rd, we wrote on this same subject to the following effect:—"Secondary batteries are being much improved, and their weight for producing a given effect much reduced, and we can yet conceive each carriage supplied with three or four cells to work low resistance incandescent lamps so as to render each car independent of the rest."

The Lighting of the Inventions Exhibition.—That portion of the building devoted to electrical exhibits is, curiously enough, illumined at night by means of pretoleum lamps.

Electric Lighting at Leeds.—At last week's meeting of the Leeds Town Council a deputation was received from the Leeds Musical Festival Committee with reference to the lighting of the Victoria Hall, where the festival is held. Alderman Spark, who introduced the deputation, deprecated the proposed removal from the hall of the electric lighting apparatus and the replacing of the gas sunlights. It was argued that the sunlights caused a draught upon the heads of the people, and also created an amount of heat which produced serious inconvenience. Everyone who had had experience of the gas sunlights and the electric light had been much impressed by the superiority of the latter. A Member of Council asked if it was right that unsightly fixtures should remain in Victoria Hall in order that the musical festival might be accommodated one week in three years. The public were annoyed at the unsightly nature of the electric lighting apparatus. It was stated on the other side that the sunlights were more unsightly than the electric lighting apparatus. The Mayor promised that the matter should have careful consideration.

At the same meeting of the Council, on the motion that the minutes of the Electric Lighting Committee be adopted, Alderman Boothroyd asked what the committee was really doing, especially with respect to the lighting of the Free Library. [A voice: "The least said the better."] The Town Clerk replied that a case was pending against the Corporation which would come up at York Assizes. The whole question would come before the Court. Mr. Webster, Q.C., Mr. Lockwood, Q.C., and Mr. Moulton had been retained on behalf of the Council.

Telephonic Charges.—The committee appointed by the Leeds Chamber of Commerce to make enquiries with respect to telephonic charges, reported to a meeting of the Chamber held last week, that there did not seem to be any prospect of obtaining for some years, in consequence of patents and other things, such cheap telephonic communication as there was in Germany and other countries. The charges in this country were something like double what they were in Berlin and in other German towns. In that country the telephone was a Governmental affair, and the Government had been able to make larger concessions than could be obtained here. It was proposed by the committee to endeavour to obtain, by the issue of a circular, the list of charges in the large centres in England, Scotland and Ireland, so that the differences which existed in charges might be ascertained.

The Monopoly of a Telephone Exchange.—During the recent negociations of the Portsmouth Chamber of Commerce with the Western Counties and South Wales Telephone Company, which have had the result of securing for Portsmouth the undoubted advantage of a telephone exchange, Mr. A. W. White, the manager of the local Tramways Company, frequently protested against the company being allowed to acquire a monopoly, unless it was within the power of the subscribers, in case of their being dissatisfied with the manner in which it was worked, to purchase the exchange. Mr. White has now written a letter to the Town Clerk (Mr. Alexander Hellard) in which he states that he has done all in his power in his individual capacity to draw terms from the telephone company, and the result had been a letter from the hon. secretary of the Chamber of Commerce, in which he promised certain conditions which, however, fell far short of what he considered the community should secure. Those conditions, too, were only promises which might be broken at any moment, although he had no doubt that they were now made in good faith. Many business men in the town were naturally desirous of this means of communication, and some had already signed contracts with the telephone company. Seeing no alternative he had done the same, but he felt very keenly that for present individual advantages he was assisting to seal a monopoly which in a few years might be regarded as a great evil, as against which the monopolies regulated by Parliamentary restrictions would sink into insignificance. Before things went too far he submitted to him (the Town Clerk), as the legal and official head of the borough, whether some steps should not be taken so as to secure to the Town Council full control over the exchange in the interest of the community. If such was not done he was certain that in seven or eight years there would be a general outcry as to how on earth the authorities of to-day could have allowed such a serious innovation without proper restrictions and reciprocal agreements.

Telephone Wires.—At the last meeting of the Brighton Town Council, the Works Committee reported that they had resolved, at a meeting on the 1st inst., that in compliance with the application of the secretary to the General Post Office, the corporation, so far as they lawfully could, and subject to conditions set out, should consent to the erection by the Postmaster-General of a line of telephone from the premises in Edward Street, in the occupation of Messrs. Savage and Adams, to their places of business in High Street, St. James's Street, and Marine Parade, Kemp Town, and to the placing by him of two wires over the following streets in the borough, namely, Edward Street, Devonshire Place, High Street, St. James's Street, and German Place, from whence the wires were to be carried underground to the Kemp Town premises. On this clause Councillor Carpenter strongly protested against the placing of telephone wires overhead, and urged that the council should not accord their permission. All wires should be laid underground, as overhead wires were a constant source of danger to the public. Alderman Sendall pointed out that they were in a somewhat difficult position, because the Corporation had already given to the Postmaster-General permission to erect overhead wires subject to certain restrictions. Councillor Berry, whilst admitting that occasional disadvantages arose in consequence of overhead wires, thought that in allowing the wires in question to be erected they were only doing a simple act of justice. The proceedings of the committee were then confirmed.

Councillor Berry appears to us to have made the most sensible comments, and we think it would be well that men of such positive assurance as Mr. Carpenter should understand a little of that upon which they so glibly dilate. Overhead wires are no more a constant source of danger to the public than is Brighton Pier, which, we think, Mr. Carpenter would hardly like to see under water.

Telephonic Notice.—The National Telephone Company, Limited, begs to intimate that the second edition of their List of Subscribers will be issued on 1st June. Intending subscribers should therefore send in their names at once, so as to ensure their being included. Exchange subscription, £10 per annum (within one mile of exchange). Full particulars on application to James Townsend, District Manager, 9, Union Street.

Telephone Operations at Inverness.—The district manager of the National Telephone Company at Inverness supplies us (the *Northern Chronicle* of May 6th) with the following particulars regarding the work of the past four months :—" It is scarcely four months since we began our exchange in Inverness, and to the list issued at that time (19th January, 1885) we have since added 11 new names, while I am at present negotiating with the estates of Dochfour (including a connection for Mr. Needham, Dochgarroch Lodge) and Aldourie, and also for the establishing of a call office at Dochgarroch Locks, for the convenience of the steamer passengers and others resident in that district. By means of this office tourists may secure accommodation, and order their dinners at the hotels they prefer, during the interval in which the steamer is going through the Lock. The fee for speaking from Dochgarroch to Inverness will be the same as is at present charged in town, viz., 3d. for three minutes and 1d. for every minute additional. Since we opened we have taken an average of about 2,000 messages weekly, including 100 from call offices alone. That these call offices are being taken advantage of by the public there can be little doubt, as no less than 140 out of a total of 1,400 received have been paid for, representing an average of 10 per cent. There are at present about 60 subscribers in town, and each subscriber uses his telephone at least six times per day, thus, at the yearly rental of £10, the cost of each message is on an average about 1⅓d. This includes question and answer. It will also be of interest to know that the company have now over 60 instruments in operation and 26 miles of wire, there being a telephone to every 300 persons in Inverness. As the switching arrangements are now completed, it will give me much pleasure to show and explain the system to any who may favour us with a call."

Telephonic Exchanges.—We understand that Mr. H. C. Grahame, who opened the exchange at Plymouth for the United Telephone Company, is now at Northampton endeavouring to form an exchange for the South of England Telephone Company. The Post Office has not been idle at Northampton during this lapse of time, and has many private lines in the town.

Telephone Extension.—At the last monthly meeting of the Ayr Town Council, on Monday, a communication from the National Telephone Company of Scotland was submitted. It was decided to allow poles for wires to be erected as far as Tam's Brig, on the Prestwick Road, and thereafter to lay the wires as may be arranged without poles.

New Cable Steamers.—Messrs. R. Napier and Son, Govan, have been successful in their negotiations with the Eastern Extension, Australasia, and China Telegraph Company, in reference to the construction of a telegraph ship to take the place of the *Magneta*, lost a few weeks ago in the Bay of Biscay. The Messrs. Napier have received orders to proceed at once with the construction of a new vessel, which will be of similar dimensions to the *Magneta*—850 tons, 230 feet long, 32 feet in breadth, and 24 feet deep, and supplied with compound engines of 1,400 horse-power, to attain a speed of 12½ knots. The new vessel, like her predecessor, is intended, and will be specially fitted up, for laying, picking up, and repairing the submarine cables of the telegraph company for which she is to be built. The lost *Magneta* was constructed of Cumberland steel, but the new vessel will be built of Scotch steel.

It is reported that Messrs. Napier have just concluded an order for a second steel screw-steamer for the Eastern Extension, China and Australasia Telegraph Company, of 250 feet in length by 34 feet beam.

Cable Repair.—We learn that the repair of the oldest of the cables which connect Havanna with Key West (Florida) was effected on 11th inst. by the ss. *Dacia*. Considering the difficulties offered by the current there (which sometimes attains a speed of five knots per hour), we think that those on board are to be congratulated on the rapidity with which this work has been carried out ; the ship having only arrived at Key West on the 29th ult.

Telegraphic Communication in the Hebrides.—In the House of Commons on Friday week Sir T. Brassey, in answer to Lord C. Campbell, said the attention of the Admiralty had been directed to the want of telegraphic communication between the mainland and some of the Outer Hebrides. No doubt such communication would be desirable in certain circumstances, but the Admiralty did not consider it necessary at present to incur the large expenditure which the work would require.

Sixpenny Telegrams.—At the meeting of the Glasgow Chamber of Commerce, on Monday, in reference to the Postmaster's proposal for sixpenny telegrams, the committee were of opinion that had it been brought before them at an earlier stage, it might not have been unreasonable to have asked some change in the Bill—for instance, that ten words might be given for sixpence, with a charge made for the name and address of the sender, but without any charge for the name of the recipient. That would have been getting for sixpence exactly the half of what they had for a shilling. The committee, however, felt the suggestion would come too late, and they considered it wise not to endanger the passing of the Bill to gain such an end. On the motion of Mr. Sandeman, seconded by Sir James Watson, and supported by Mr. Stephen Mason, it was agreed to petition Parliament in favour of the Sixpenny Telegram Bill.

A Glasgow contemporary learns, on good authority, that there is every likelihood of the Postmaster-General again postponing the introduction of the sixpenny telegrams. The certain loss which it is likely to entail to the Government for some years, and the already many financial difficulties with which they have to contend, are the reasons put forward, and should the Opposition prove strong in regard to addresses being charged for, I hear that the Postmaster-General will drop the Bill altogether, and indefinitely postpone the introduction of the sixpenny rate.

Overhead Wires.—In a leading article on overhead wires, a Glasgow contemporary says:—"The question of the danger to the public from overhead telegraph and telephone wires has once more been raised, and this time in a way which may command a little more attention on the part of the Post Office department than has been paid to expressions of public opinion on the subject. Dr. Percy, the President of the Iron and Steel Institute, says it is no imaginary danger, for there has been at least one fatal accident from this cause. Life, it is said, hangs upon a thread, and now, according to Dr. Percy, the lives of the inhabitants of large towns may be said to hang upon a wire—which is but a metallic thread—and, with much greater reason, to depend upon a heavy telegraph cable. The President of the Iron and Steel Institute says that should any great diminution in the tensile strength of these wires from physical or other causes occur in the course of time, it is difficult to conceive how mischief in consequence could be prevented, inasmuch as it would, to say the least, be exceedingly difficult to make a proper inspection of them; and, moreover, even if such inspection were easily practicable, it would probably be neglected until a political dignitary like the Home Secretary or the Postmaster-General should happen to be strangled or, it might be, decapitated by a broken wire, or crushed by a heavy cable. In the event of such an unhappy accident, Dr. Percy thinks that this unsightly and dangerous nuisance might possibly be suppressed."

We (the ELECTRICAL REVIEW) should be glad to know whether Dr. Percy would not like to free our streets from the immense vehicular traffic which goes on ever increasing, because more than 100 persons per annum are killed by being run over in our streets. He might retort that this traffic is necessary for our daily business transactions; well, so are overhead telegraphic and telephonic wires.

At a meeting of the Hull Town Council held last week, a discussion arose as to whether an application from the Post Office to carry a wire over certain streets should be granted. On a division, the application was granted by 39 votes against six.

The Cruto Incandescence Lamp.—Mr. T. Girolamo, writing from Turin on the 4th inst. to *Engineering*, gives the following list of the Cruto lamps, as they are made usually, with their working constants:—

	Candle.	Volts.	Ampères.
1	4	5	2·80
2	8	9	2·80
3	12	50	0·85
4	16	50	1·05
5	24	100	0·85
6	32	100	1·05
7	50	50	2·25
8	100	100	2·25

This gentleman further says:—The Cruto lamp is distinguished above all others both for its agreeable effect of light and for its high durability, so that in the interest of my customers I have now decided not to make use of any lamp other than the Cruto, which gives the best and most reliable results.

The Prospects of War.—It would appear, if we may judge from the orders received by one electric light company only, that the prospects of war have had a very salutary effect upon the electric lighting industry. Let us hope that when a permanent peace has been secured such work will suffer no relapse.

Mr. Cyrus W. Field.—The retirement of Mr. Cyrus W. Field, after half a century of public life, will be a source of regret to many in the electrical world. Commencing as a clerk for Stewart at a dollar a week, he has earned his place as a millionaire. Twenty years after his humble start we saw the Atlantic cable finished, owing principally to his untiring energy and perseverance, and the City Hall in this city proclaiming in hundreds of gas jets, "Honour to Cyrus Field." Later, as national recognition, came a gold medal from and the unanimous thanks of Congress, and then the knighthood, which he virtually declined, and which Captain James Anderson, of the *Great Eastern*, received from Queen Victoria. Relieved now of the personal cares and responsibilities which have weighed so long upon him, Mr. Field may live a long and honourable life in private. Mr. Field should rank in the history of the telegraph with Prof. Morse, Amos Kendall and William Orton.—*Electrical World.*

Admiralty Contracts for Dynamos. &c.—Contracts have been entered into by the Admiralty with the Anglo-American Brush Electric Light Corporation for supplying with all possible despatch complete sets of Victoria slow-speed compound-wound dynamos, with engines, to the following vessels, viz., six sets to H.M. gunboats, *Medway*, *Spey*, *Tees*, *Medena*, *Slaney*, and *Tay*; two sets to H.M. tugboats *Woodcock* and *Magnet*, and twenty sets for the picket boats which are now building for the Admiralty. Three of the dynamos for the gunboats will be driven by engines supplied by Messrs. Goodfellow and Matthews, and the remainder of the engines are to be furnished by Messrs. Willan and Robinson.

Dynamos for the War Department.—The Anglo-American Brush Electric Light Corporation has received orders to supply by the first week in July twenty-three of their compound-wound slow-speed dynamos for use in submarine mining.

The Inventions Exhibition.—The management of the Inventions Exhibition is apparently not of a character to secure, so says the *Financial News*, its success or its popularity. In the first place season tickets, or tickets which are sold as such, at a guinea each, are only to be obtained inside the Exhibition, so that they actually cost 22s., and, even at that price, they do not admit the holders at all times, although no mention of the excepted days is made in the advertisements. The subway from South Kensington Station to the Exhibition is also made a source of revenue, although the public are not informed of the fact until they get into the subway, when they find that they cannot get out again except by paying a penny at each turnstile going to and coming from the grounds. Mean impositions of this kind will go a long way to impair the popularity of the Exhibition, which, if it is to be a success, should be conducted upon broad and generous principles.

Contract.—Long Reach (near Dartford), May 23.—House.—For erection of a machinery house for the electric lighting of the hospital ships moored at Long Reach, near Dartford, Kent, for the Metropolitan Asylums Board, in accordance with plans and specifications, which, together with the conditions of contract, may be inspected at the offices of the architects, Messrs. H. Jarvis and Son, No. 29, Trinity Square, Southwark, S.E., between the hours of 10 and 5. Sealed tenders, endorsed "Tender for the Erection of a Machinery House for the Electric Lighting of the Hospital Ships," are to be delivered, with the priced quantities, at the offices of the board, 37, Norfolk Street, Strand, W.C., by or before 10 a.m. on 23rd inst. Mr. W. F. Jebb, 37, Norfolk Street, Strand, W.C., is clerk.

Electrical Catalogues.—The Western Electric Company is getting out a new catalogue in three languages —English, French and German—for use at their Antwerp factory.

Interesting to Shipowners and Shipbuilders.—Rather a smart feat in electric lighting was accomplished on Monday last at Messrs. Palmer & Co.'s dry dock, Jarrow-on-Tyne, where H.M. transport *Albatross* has been placed for repairs, the completion of which being urgently required necessitated working continuously day and night. In order, therefore, to facilitate the work, Messrs. Palmer considered it advisable to light the dock by electricity, and it is satisfactory to learn that within 8½ hours after receipt of instructions Messrs. Clarke, Chapman & Co., Gateshead, had one of their new portable electric light machines and boiler delivered at Jarrow, and everything in full working order, the light giving the greatest satisfaction. Evidently such a machine would be very useful during the execution of hurried repairs on board ship, or when docking vessels.—*Liverpool Journal of Commerce.*

Messrs. Blakey, Emmott & Co.—The contract for the supply of telegraph apparatus and batteries to the Manchester, Sheffield and Lincolnshire Railway Company has been secured by Messrs. Blakey, Emmott and Co., of the Northern Telegraph Works, Halifax. This firm has just issued a handsome catalogue in three parts—Part I. containing Railway Signal Apparatus, Resistance Coils, Galvanometers, &c.; Part II., Electric Bells, &c.; and Part III., Electric Light Machinery.

The Regulation of Speed of Electro Motors.—Respecting this communication of M. Deprez's, to the French Academy of Sciences, M. Hospitalier, the editor of *L'Electricien*, writes as follows:—Whilst admitting that M. Marcel Deprez was the first to apply double winding to generating machines for *distribution* at a constant intensity, or constant potential,—double winding had been employed beforehand by Mr. Brush, in the electroplating machines, his device being known under the name of "teaser,"—we must assert that the employment of double winding, in order to produce motion at a *constant speed*, was announced for the first time by Messrs. Ayrton and Perry, at the meeting on May 10th, 1883, of the Society of Telegraph Engineers and Electricians, just two years ago. Messrs. Ayrton and Perry gave a more complete solution of the problem than does M. Marcel Deprez, since they took into consideration the two conditions of distribution, constant potential and constant intensity, whilst M. Deprez only indicates the condition of constant potential. Render unto Cæsar, &c.

Breaking Insulators.—At the Sheriff Court, Campbeltown (Kintyre), on Friday week, before Sheriff Dundas, two farm servants named Charles M'Taggart and Walter M'Connachie were accused of maliciously breaking with stones two insulators on the telegraph line on the Carradale Road. They pleaded guilty, and were each fined in the sum of £1, with the option of seven days' imprisonment, the Sheriff expressing his determination to put down this kind of offence if not by fine by imprisonment.

Personal.—At a special meeting of the Salford School Board, held on the 11th inst., Mr. Joseph Rice moved that Mr. Walter T. Glover, electric cable manufacturer, Salford, should be elected a member of the board. He said that Mr. Glover's sympathies would be found to be fully with them in the matter of education. He was a large ratepayer, and would no doubt, therefore, keep an eye to the expenditure of the board. He believed, also, that Mr. Glover would be found a most courteous colleague with whom it would be a pleasure to work, and that he would be generally acceptable to the board. Mr. P. Bury seconded the resolution, which was passed. Mr. Glover was placed upon the several committees of which Mr. Walmsley had been a member.

The Fastnet Cable.—The laying of the submarine cable connecting Lloyd's Signal Station on the Fastnet Rock with the mainland at Crookhaven, was successfully accomplished on Thursday. Vessels which pass this station and wish to be reported can now be signalled and reported by telegraph direct from the Signal Station on the Rock.

The Results of Over Study.—An inquest was held at Plumstead on Saturday last on the body of Walter Edward Burrell, aged 19, who committed suicide by shooting himself with a revolver. The father stated that the deceased had been employed by the Brush Electric Light Company, and had of late been studying electricity and kindred subjects, which had injured his health. He left the company, and got employment in the Arsenal, but could not bear the noise of the machinery, and took his discharge. On the Thursday night he shut himself up in his bedroom, and a few minutes later the report of firearms was heard, followed by a heavy fall, the young man having shot himself with a five-chambered revolver in the right temple.

Inventors' Institute.—On Monday, 18th May, at 8 p.m., a paper will be read "On Electric Tram Cars," by A. Reckenzaun, Esq., C.E., at the Institute, Lonsdale Chambers, Chancery Lane.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Volta Electrical Company, Limited.—An agreement, dated 10th ult., and filed with the documents of this company on the 8th inst., regulates the purchase by the company of the plant, stock-in-trade, office furniture, book debts, patents, goodwill, &c., of the business of electrical engineer and contractor, carried on by Mr. Frederick D'Artrey Goold, in Manchester. The consideration is £3,142, payable by the allotment of 2,142 fully paid preference shares of £1 each, and 1,000 fully paid-up deferred shares of £1 each. The vendor is appointed manager of works and contracts for three years, at a salary of £5 per week.

Foreign Pilsen Electric Light and Power Company, Limited.—Upon terms of an agreement of 23rd February, filed on the 8th inst., this company will purchase the property and assets of the Union Electric Light and Power Company, Limited, for 30,000 fully paid shares of £1 each.

New Telephone Company, Limited.—An agreement, dated 6th inst., and filed on the 8th inst., provides for the allotment of 1,000 fully paid shares of £5 each to Professor Silvanus Phillips Thompson, in satisfaction of the proportion of the first issue of shares, to which he is entitled by virtue of an agreement dated 14th of February.

Telpherage Company, Limited.—The annual return of this company, made up to the 7th inst., was filed on the 8th inst. The nominal capital is £50,000 in £10 shares. 1,550 shares have been taken up, and £7 per shares has been called upon the A shares, the total calls paid amounting to £10,850. As compared with the previous return the paid-up capital shows an increase of £4,730. Registered office, 53, Old Broad Street.

Telephone Company of Egypt, Limited.—The annual return of this company, made up to the 2nd inst., was filed on the 4th inst. The nominal capital is £100,000, divided into 16,000 preference and 4,000 deferred shares of £5 each. 12,071 preference and 4,000 deferred shares have been taken up and the full amount has been called thereon, the total calls paid amounting to £80,355. Registered office, 14, Austin Friars.

CITY NOTES, REPORTS, MEETINGS, &c.

Great Northern Telegraph Company.

At the annual general meeting, held at Copenhagen on the 25th April, 1885, F. Zahle, Esq., presided.

The Chairman, C. F. Tietgen, Esq., addressed the meeting with regard to the working year of 1884, by first of all referring to the cables owned by the company. The state of the same had been, so to say, normal; there had been the ordinary rather numerous cases of interruptions, but in no instance had these sensibly affected the company's receipts. Amongst these interruptions one, however, deserved to be specially referred to, viz., a breakage which occurred in one of the cables in the Gulf of Bothnia, on the 13th December last.

Thanks to the precautionary measure taken in 1883, when a third cable was laid across the Gulf, as explained at the last general meeting of the company, this interruption had caused no inconvenience, and they had been enabled to postpone the repairs of the same until the more propitious spring season. The shareholders would have observed from the monthly traffic returns which had from time to time been published, and from the profit and loss account which had been laid before them, that the net revenue had been larger than in 1883. This increase had not been due to the receipts on the company's European lines, on which, on the contrary, there had been a diminution of traffic, owing to the general stagnation of trade; but was exclusively attributable to the increase in the receipts derived from the company's lines in the far East. The receipts from the latter might have been considerably larger had it not been for certain stipulations contained in the French and Chinese concessions, in accordance with which some classes of Government messages, of which there had been a great number during the year owing to the war, had to be transmitted free of charge. Notwithstanding, or perhaps owing to, the political disturbances in China, the development of the inland telegraph system in that country had been actively progressing. The land line connecting Hankow, the great commercial centre in China, with the general inland system, had been completed, and after several intermediate stations had successively been established, the station at Hankow was opened for traffic on the 15th June last. On the 22nd August, the first telegraph station had been opened at Peking, and no doubt the establishment of the telegraph in the Capital had contributed largely toward the acceleration of the final peace negociations between China and France. A new line had also been constructed in the North of China, connecting Newchwang and the new Chinese naval establishment at Port Arthur (Port Li). In the South of China a line had been constructed from Canton to the Tonkin frontier, and branching off to the important Island of Hainan. As all these and other Chinese land lines could in a great measure be considered as feeding lines for the company's cables, the company had so far hailed their establishment with great satisfaction, although it had not from the very beginning been overlooked that the development of the Chinese land line system might sooner or later also prove competitive as regarded the company's cable routes. A land line had, in fact, last year been opened between Foochow and Canton as a continuation of the Chinese Shanghai-Foochow line, thus creating a competition with the company's Shanghai-Amoy-Hong-Kong local traffic. It was, however, confidently believed that the general development of the telegraph correspondence would not fail to counterbalance any threatening influence of some competitive land lines, and hitherto the financial results had not given rise to any serious apprehension. The telegraph field which the large commercial ports on the coast of China offer is so vast that there would be room enough for both cables and land lines. Meanwhile the company had not lost sight of the fact that by the concession granted on the 8th June, 1881, the Chinese Government guaranteed the company against such competition, and naturally the company had immediately, when the same arose, remonstrated against the breach of this obligation. Up till now, however, only evasive answers had been received from the Chinese authorities, who appeared to meet certain difficulties in carrying out the engagements entered into by the Government. Considering that latterly grave political matters have engrossed the attention of the Chinese, it had not been deemed opportune at this present moment to press for an immediate favourable decision with regard to the company's legitimate rights. In order, however, that the moderation thus shown by the company should not be misunderstood, due notice of the infraction had been given, and in order to reserve their rights the company had, fully agreeing in this measure with the Eastern Extension Telegraph Company, provisionally stopped the free transmission of the Chinese Government telegrams. Thus the matter stood at present, but the company trusted that, when the political horizon in China had been cleared, the moment would arrive when the Government would find means to conciliate their own interests with the undoubted rights of the company. Meanwhile the company were in possession of the opinion on this point of both eminent statesmen and legal authorities well versed not only in International law, but also well acquainted with Chinese institutions and customs, which opinions assured the company of the perfect legality, even from a Chinese point of view, of their claims under the concession granted in 1881. With regard to other matters, the chairman would only mention that the exchange of the old share warrants against new ones, referred to last year, had now been effected, and apparently to the satisfaction of everybody concerned. Also that the capital of the pension fund for the staff had been separately invested, and would therefore in future not figure in the balance sheet. From the balance sheet, which had already been placed before the shareholders, it would appear that after all the general charges, as well as the ordinary charges for interest and amortisation of debentures, and the payment of the usual 5 per cent. interim dividend during the past year had been provided for, there remained an amount of £135,504 11s. 9d., which the directors submitted to the meeting to deal with as follows:—£45,833 6s. 8d. to be divided amongst the shareholders as an extra dividend of 3 per cent. (making the dividend for the year, including the interims already paid, 8 per cent.); £2,777 15s. 7d. to be allotted to the pension fund for the staff; £55,555 11s. 1d. to be added to the reserve and renewal fund; and £31,337 18s. 5d. to be carried forward tonext year's account. It was with much regret that the chairman had to announce that the company had again suffered a great loss by the death of two members of the board of directors, Mr. Julius Sick and Mr. Moritz G. Melchior. The former had been a member of the board from the formation of the company, and the latter joined the board in 1874. Both had, by taking great interest in the company, contributed considerably towards its ultimate success, and he was convinced that the shareholders would much regret their loss. To fill up the vacancies which had thus occurred, the directors had asked C. St. A. Bille, Esq., late Minister for Denmark in the United States, and M. Melchior, Esq., to join the board.

Without discussion the report was then unanimously adopted, the accounts were passed, and discharge given to the board of directors.

The retiring director, the Chairman, C. F. Tietgen, Esq., was unanimously re-elected. The election of C. St. A. Bille, Esq., and M. Melchior, Esq., as members of the board, was also unanimously confirmed, and A. Berner, Esq., and Aug. Garde, Esq., were re-elected as shareholders' auditors.

The Submarine Cables Trust.

MR. JOHN PENDER, M.P., presided over the annual meeting of this Trust, held on Tuesday afternoon at the offices, 66, Old Broad Street. The attendance was very limited. The report, published in our last issue, having been presented,

The Chairman said: Gentlemen; you have had the report in your hands. Will you take it as read? I wish to make one or two remarks as to what has been done during the past year. The accounts now presented are made up in the usual form, giving the fullest information as to the position of the Trust. The amounts which the trustees had to deal with last year were, as dividends from investments, £24,449. The expenses were £1,324; payment of coupons absorbed £20,289; in purchasing nine certificates £886 has been spent, and £1,950 is carried forward. It is anticipated that we shall be able to pay the coupons in full, and leave a small balance. The Atlantic cable competition is a very serious matter. The present tariff is not one which can be regarded as remunerative. The last dividend received from the Anglo Company a few days ago was only £490, as against £1,544 in the corresponding quarter of 1884. This competition at the present moment is not likely to lead to higher dividends. The chances are, I am sorry to say, that it will lead to a lower. The present tariff is not remunerative in any degree even to the company which has just established another line—I mean the Mackay-Bennett Company. They must be incurring a very serious loss from the transfer of their money from other investments in America into this system. So far as I can see, if they keep their accounts as they ought to do, they cannot show much over 2½ per cent., although having new cables, and with all the advantages of modern science and lower cost to place them in a satisfactory position as regards competition. On the other hand, the Anglo-American Cable Companies and others have a certain goodwill in the business, and if it comes to competition, I have no doubt they will be able to do their business well and efficiently. At the same time that will not bring the money, and what I look forward to is, by-and-bye, that it will be absolutely necessary, in the interests of shareholders, and of the properties, that some re-arrangement of the tariffs shall take place. When that happens the investment of the company will participate in the advantages. Fortunately the other companies in which we hold considerable interests are doing perhaps better than they were doing, and the consequence is, that what we lose by the Atlantic systems we benefit in the others. Therefore we may congratulate ourselves that there is no difficulty in the payment of the coupons. Almost one-fifth of the capital of the trust has been redeemed, and the marked coupons holding certificates are about at par; that is, 10 per cent. above the price of issue. We are entirely dependent upon the incomes received from other companies. As a rule, our investments in other companies are such as to enable us to keep paying our coupons, and I am very hopeful that before the year passes there will be some arrangement made whereby the Atlantic system will give a better dividend than it does at the present moment, in which case it will, of course, benefit us. I will therefore propose that the report and accounts now submitted be approved and adopted.

Sir D. Gooch seconded the motion.

A Shareholder: Is there very much increase in the volume of the business of the Atlantic Company?

The Chairman: I am sorry to say that the amount taken over all the systems is considerably less than it was last year.

A Shareholder: Is there an absolute increase of messages to any extent?

The Chairman: Oh, no! if there were we should naturally have an increase of income.

A Shareholder: Then the cheap rates do not produce augmentation of business?

The Chairman: Oh, no! When the Mackay-Bennett Company opened their system at 1s. 8d., as against the 2s. previously charged, there was a clear loss resulting of £150,000—money which you might just as well have chucked into the sea—there is no return for it. The difference is so small, so infinitesimal on the amount of telegraphing done, and there has been no increase, so that the shareholders have received no benefit. I am hopeful that common sense will prevail eventually, and that a tariff will be established which will give a fair return to those who invested their money.

The report was then unanimously adopted, and the auditors having been formally re-appointed with a salary of £25 each, the proceedings terminated.

London Platino-Brazilian Telegraph Company.

Mr. Pender, M.P., presided at the offices, 66, Old Broad Street, over the seventh ordinary general meeting of the shareholders in the above company. He stated that there had been an increase in the receipts over the land lines in Uruguay, the amount in 1884 having been £3,271, as against £2,646 in 1883. Since he last addressed them the debt which the Government of Uruguay had owed them for a long period, and as to which they were at one time not over sanguine, had been paid. The amount stood at £7,360, but it had been paid off in bonds at par, on the realisation of which there had been a loss of £2,937. This was a settlement much of the same kind as had been arranged in other cases. The Government accounts had been paid to the end of January, and they had urged their agent to see that the Government paid their messages account regularly in future. He was glad to say that their agent was on very friendly terms with the Government, who were not rich, as they all knew; but they appreciated the mode in which the company were doing their work, and, consequently, they were the more disposed to pay their accounts to the company. They were now doing a very fair amount of business. With regard to the cable receipts, the revenue in 1883 was £12,638, whereas in 1884 it was £10,665, and the difference would have sufficed to pay another ½ per cent. more dividend. The dividend last year was 2 per cent., and this year it was only 1½ per cent., but they carried over £1,046, which was available for the equalisation of dividend in the future, or otherwise as occasion might warrant. Some portion of the decrease in the receipts was owing to an interruption of the cable of the Brazilian Submarine Company for more than three weeks in March, 1884, but it was mainly through the reduction of the tariff of the Western and Brazilian Company. He might mention that the negotiations between the last mentioned company and this company were still going on. The Western and Brazilian Company had been attempting to make some arrangements with the Brazilian Government, who, he was sorry to say, were not acting in the spirit which they promised when submarine telegraphy was first laid on their shores. He concluded by moving the adoption of the report and accounts, and the payment of 1s. 9d. a share.

The resolution was seconded by Mr. John Hollocombe, and carried. The usual complimentary vote to the chairman and directors closed the proceedings.

The West India and Panama Telegraph Company, Limited.

THE report of the directors, to be presented at the 16th ordinary general meeting, to be held on May 20th, is as follows:—

The amount to credit of revenue (six months ending 31st December, 1884), is £40,983 2s. 6d., and the expenses have been £26,047 19s. 8d., leaving a balance of £14,935 2s. 10d., which, with the balance of £3,933 18s. 0d. brought from last account, makes a total of £18,869 0s. 10d. Of this sum the directors have placed £8,000 to reserve, leaving an available balance of £10,869 0s. 10d. with which it is proposed to deal as follows:—

	£	s.	d.
Payment of 6s. per share on account of arrears of dividend on the first preference shares ...	10,368	18	0
Balance to current half year's account ...	500	2	10
	£10,869	0	10

The traffic receipts show an increase of £535 16s. 4d. over those of the corresponding period of last year.

The directors have much satisfaction in announcing that their long continued efforts to effect the complete restoration of the original cable between Jamaica and Porto Rico have been successful; this important work having been accomplished on the 24th October last by the company's ss. *Grappler*. The line (700 knots in length) has since continued in good working order.

By the re-establishment of this cable (which had been inoperative since 1874) the duplication of the most important section of the system is restored, and the colonies eastward of Jamaica have already realised the advantages of the duplication during two interruptions of the Jamaica-Ponce cable which have occurred since the repair was effected.

The value of the capital expended during the half year on this restoration amounts to £6,917 15s. 8d., which has been charged to the reserve account. The expenditure from first to last involved in the restoration amounts in the aggregate to £33,657, and this heavy outlay constitutes a further claim on the colonies which have not increased their subsidies beyond the original sums granted many years ago. At the time those grants were accepted it was contemplated both by the colonies and the company that a single line of cables would secure the communication, which subsequent experience has proved to be a misapprehension.

The colonies of Barbadoes, Guadeloupe and Martinique have renewed their subsidies for further terms of years.

The company's appeal for a renewal of the St. Thomas subsidy, which expired on the 31st December last, is now under the consideration of the authorities of that colony.

Several interruptions to the cables occurred during the half year under report, and the company's ships have been frequently employed in repairing operations.

Since the repair of the Jamaica-Porto Rico cable, the ss. *Grappler* has been chiefly engaged in the examination of the original (duplicated) cable between Jamaica and Santiago de Cuba which has long been inoperative, but much difficulty has been experienced in the operations from time to time owing to the great depth of water and rocky ground. The ship is at present engaged on other repairs, but will return to this work when at liberty.

The company's second repairing ss. *Duchess of Marlborough* will shortly come to England to be re-fitted. On her return to the West Indies she will take out a further supply of new deep-sea cable for reparing purposes.

In accordance with the articles of association, Charles William Earle, Esq., and William Ford, Esq., retire at this meeting, and offer themselves for re-election.

John George Griffiths, Esq., the auditor, also retires and offers himself for re-election.

Mediterranean Extension Telegraph Company.—The closing of the transfer books of this company is announced by the liquidators preparatory to the payment of £1 per share on the ordinary and preference shares of the company, making, with the dividend on the Eastern Telegraph Company's 4 per cent. mortgage debentures, a total distribution of £3 per share.

The Great Northern Telegraph Company.—The final dividend of 6s. per share for 1884 is now payable at the company's bankers, Messrs. C. J. Hambro and Son, 70, Old Broad Street, London, E.C.

The Eastern Telegraph Company.—This company notifies the opening of a new telegraph station in China, Yamchow, the rate from Great Britain being 10s. per word.

TRAFFIC RECEIPTS.

The West Coast of America Telegraph Company, Limited. The gross earnings for the month ending April 30th were £4,215.

PROCEEDINGS OF SOCIETIES.

Physical Society, May 9th.

THE meeting was held in the physics theatre of Clifton College Bristol, in consequence of an invitation from the British Naturalists Society. Prof. GUTHRIE, President, in the Chair.

Messrs. E. Cleminshaw, E. F. Herrom, and A. L. Selby were elected members of the society.

The following communications were read:—

"On Evaporation and Dissociation," by Prof. W. RAMSAY and Dr. S. YOUNG. The authors gave the results of a series of investigations undertaken with the view of determining how far the passage of a liquid into a gas resembled the dissociation of a chemical compound. For this purpose the relation between the pressure and temperature of several dissociating substances, such as ammonic, carbonate, chloral hydrate, and phthalic acid had been examined. The authors hope shortly to publish the full details of these experiments, and the conclusions arrived at.

"On a Model Illustrating the Propagation of the Electromagnetic Wave," by Dr. S. P. THOMPSON. The model consists of two sets of beads. Each set is composed of a number of beads fixed to the extremities of wires, and by a suitable mechanical contrivance each executes an approximately harmonic motion at right angles to the wires and the mean plane of the set. The phase of each bead differing by a certain small amount from the succeeding, the whole represents a wave propagation. The two sets are coloured differently, and are so placed that their harmonic motions are executed at right angles about the same axis which represents the direction of propagation of an electro-magnetic disturbance, one wave being the electrostatic and the other the electro-magnetic displacement.

"On a Self-Recording Stress and Strain Indicator," by Prof. H. S. H. SHAW. This instrument was designed for one of Wicksteed's 50-ton single lever machines, lately erected in the engineering laboratory of University College, Bristol, and has been found very simple and effective. In this testing machine the stress is applied by moving a mass of one ton along a lever; this mass is connected by a cord with a vertical cylinder upon the indicator. This cylinder carries a paper wound round it, and turns upon its axis as the mass is moved towards the end of the lever. A pencil, capable of a vertical motion, bears against this, and thus horizontal distances upon the paper are measures of stress; the strain is measured by the vertical motion of the pencil, the position of which is controlled by a wire attached to the rim of a wheel above, upom the same axis of which are other smaller wheels, any one of which can be connected to a fine wire which is carried horizontally to the upper end of the test piece, passing over a pulley fixed to it, and is fixed to the lower end. Any extension of the test piece can be multiplied at pleasure on the diagram by attaching the wire to a larger or smaller wheel.

"Note on the So-called Silent Discharge of Ozone Generators," by Mr. W. A. SHENSTONE. Mr. Shenstone had arranged some apparatus by which this could be viewed. It seemed to have the characteristics of the brush discharge.

NEW PATENTS—1885.

5587. "Instruments for measuring electricity." L. B. MILLER. Dated May 6.

5592. "Tanks and cells for electrical and other purposes." D. A. DAVIS. Dated May 6.

5601. "Apparatus for generating electricity." Hon. C. A. PARSONS. Dated May 6.

5627. "Transmitting and collecting currents in electric tramways and railways." M. H. SMITH. Dated May 7.

5657. "Lighting railway and other signal lanterns by electricity." J. E. H. GORDON. Dated May 7. (*Complete.*)

5679. "Portable electric lamps." J. C. MERRYWEATHER, C. J. W. JAKEMAN. Dated May 8.

5697. "Safety cut-outs for electric lighting." A. W. BREWTNALL, M. W. W. MACKIE. Dated May 8.

5720. "Electro-magnets." M. IMMISCH. Dated May 9.

5757. "Apparatus for making and breaking contact on distributing boards, switches and other similar electrical appliances." F. D. GOOLD. Dated May 11.

5758. "Casing for carrying underfoot telegraph, telephone and other wires, pipes or tubes." H. A. ADAMS. Dated May 11.

5772. "Apparatus for automatically regulating the electromotive force of a current of electricity supplied from secondary batteries when used in connection with dynamo machines." B. M. DRAKE, J. M. GORHAM. Dated May 11.

5801. "Electric contact makers and indicators." C. BROTHERHOOD. Dated May 12.

5804. "Taking soundings at sea by electricity." J. ROBERTSON. Dated May 12.

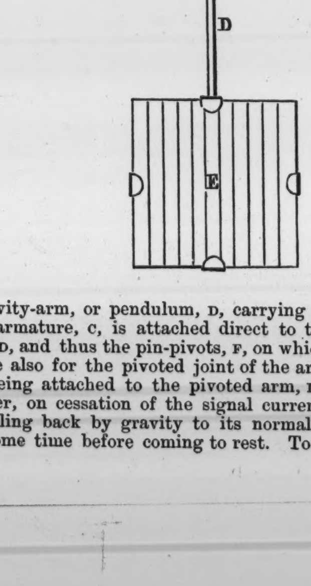
5828. "Mode of vulcanising the insulating covering of electrical conductors." B. J. B. MILLS. (Communicated by J. J. C. Smith.) Dated May 12.

5847. "Adjustable pendant or support for electric lamps." A. E. JONES. Dated May 12.

5854. "Apparatus for heliographic signalling by electricity." E. S. BRUCE. Dated May 12.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1884.

6191. "Improvements in electrical indicators." W. H. BAUGHAN. Dated April 9. 6d. Consists of a single electro-magnet, A, supported in a suitable wall-bracket, B, and provided with an armature, C, pivoted at one end, which controls the movement of an oscillating gravity-arm, or pendulum, D, carrying an indicating disc, E. The armature, C, is attached direct to the oscillating indicator arm, D, and thus the pin-pivots, F, on which the arm, D, oscillates, serve also for the pivoted joint of the armature. The armature, C, being attached to the pivoted arm, D, of the indicator, the latter, on cessation of the signal current, will be released, and, falling back by gravity to its normal position, will oscillate for some time before coming to rest. To facilitate this oscillation, the arm is pivoted on two vertical pins, *f*, *f*, resting in cups in the framing, and an adjustable weight to which is attached the indicating disc, E, conveniently a corrugated silvered mirror, or painted glass or metal, fitted to the end of the indicator rod or pendulum, D.



6232. "Improvements in electro motors." T. CUTTRISS. (Communicated from abroad by C. Cuttriss, of America.) Dated April 10. 6d. Relates to the apparatus described in the No. of the REVIEW for August 23rd, 1884.

6647. "Improvements in the preparation or production of insulating materials or articles." J. A. FLEMING. Dated April 22. 4d. Has reference to improvements upon Letters Patent dated the 22nd May, 1882, No. 2414, and has for its object obtaining greater coherence of the ingredients of which the material or article is composed, and also preventing the expansion of the material or article during the operation of moulding. The inventor takes wood in a finely divided condition or other vegetable fibrous material, such, for example, as wood-flour, bran, straw, cotton, jute, hemp, papier-maché, in a finely divided condition, and having thoroughly desiccated the same in a vacuum, or by superheated steam or otherwise, he saturates or impregnates it under pressure or not with a mixture consisting of melted bitumen or asphalte incorporated with silicate of magnesia, or silicate of lime, or silicate of iron or silicate of alumina, or two or more of such silicates used in conjunction, and with amber-resin, or other resin having a high melting point, such, for example, as Kauri resin, and he then moulds the mass under pressure into the required shape.

6863. "Improvements in and connected with galvanic batteries." J. WETTER. (Communicated from abroad by E. Vohwinhel, of Vienna.) Dated April 26. 6d. The negative electrode of the element consists of sheet lead (from 2 to 4 millimeters thick, according to the size of the element) formed into a receptacle or cell for the depolarising liquid. This vessel of lead is stiffened at the upper edge by means of a ring of brass or similar material, from which extends a strip of metal for the reception of a binding screw. At the bottom this cell may be provided with one or more cocks or valves of ebonite, glass or earthenware, for filling and emptying the cell. On the inside the leaden cell is lined with platinum, preferably in a spongy condition. The cell has in its upper edge two or more notches for the reception of thumb screws projecting from a smaller vessel and serving to suspend the same inside of the outer cell. This latter vessel serves for the reception of the oxidising substance, and may be adjusted at various heights by means of the screws. This inner vessel is ring-shaped, and provided at the bottom with perforations or holes arranged in a circle. Inside the annular vessel is situated a pot of porous earthenware, and inside of the latter a zinc plate. The annular receptacle extends only a short distance down into the lead cell, and is filled with lumps of bichromate of potash or crystallised manganate or permanganate of potash or soda free of chlorine. The lead cell itself is filled with diluted sulphuric acid in the proportion of one part (in volume) of acid at 66° Baumé to five parts (in volume) of water.

6876. "Improvements in galvanic batteries." A. SCHANSCHIEFF. Dated April 26. 6d. The elements of the battery are carbon in contact with basic sulphate of mercury and zinc, the exciting liquid is a solution of sulphate of mercury. The zinc is preferably in the U form, and it contains within it a rectangular slab of carbon. Around the carbon is wound a fibrous cord, and then over it is applied a coating of basic sulphate of mercury mixed with granulated carbon; the coating composition is kept in its place by the aid of a covering of woven fabric or parchment paper. Gutta percha rings or strips prevent contact between the coated carbon and the zinc. The battery cells thus prepared are charged with the solution of a sulphate of mercury.

7048. "Improvements in galvanic batteries." P. R. DE FAUCHEUX D'HUMY. Dated April 30. 6d. Instead of employing cylindrical or other shaped porous cells made in one piece of earthenware and placed in the centre of outer cells formed concentric therewith, or of other suitable form, the inventor employs a tank or chamber, or a series of tanks or chambers, each of which is formed on the inner face of two opposite sides with a series of vertical grooves in which is placed a series of porous earthenware slabs or plates so as to form a series of chambers within which the negative and positive elements are placed alternately. The carbon or negative elements, and the metal or positive elements, are also formed in the shape of slabs or plates provided with extended surfaces according to Letters Patent dated February 3rd, 1883, No. 592, which are placed in similar grooves to those in which the porous slabs or plates are received. The joints at the ends and bottoms of the porous earthenware slabs or plates are made tight by means of solid paraffin wax or other suitable material. The carbon slabs or plates are also made of a porous character to permit of the acid or other exciting liquid in the space between two of them passing gradually through the body of such carbon slabs or plates. Arrangements are also provided for enabling acid to be supplied from a tank as required, and for drawing off the waste liquid.

7049. "Improvements in carbons for galvanic batteries." P. R. DE FAUCHEUX D'HUMY. Dated April 30. 6d. The carbon is formed with a central hollow or solid stem, around which are a number of cylindrical or other shaped tubes at such distances apart as to leave a small annular or other shaped space between the stem and the first tube and between the succeeding tubes. The central stem and the several tubes are connected to and supported by a base, also of carbon, so as to form in effect a single carbon of compound form. The walls of all the tubes and the central stem are perforated, so as to permit the free circulation of the exciting liquid through and amongst them.

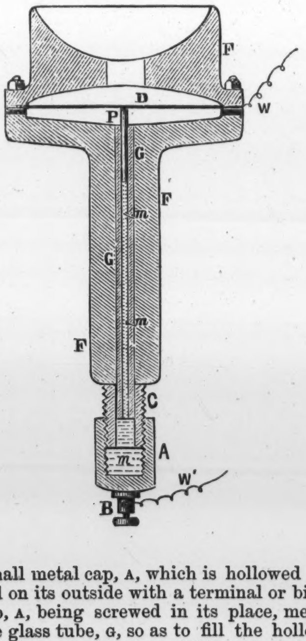
7113. "A new or improved electrically-operated stamp for post marking or for other like purposes of obliteration." N. Frere. Dated May 1. 6d. Consists in forming the device on the stamp of fine platinum wire, the ends of the said wire being connected to the respective poles of an electric battery, which may or may not be enclosed in the handle of the stamp. By these means the platinum wire is made sufficiently hot as to burn or mark the paper or other material.

7139. "Improvements in or connected with incandescent electric lamps." E. L. R. Miller. Dated May 2. 6d. Consists in principle in the replacement of a part of the conducting wire connecting one of the poles with one of the extremities of the carbon of other filament of the incandescent lamp by a small quantity of conducting material, reduced into small grains, filament, or otherwise separated, and contained in a cavity or receptacle in which the said material can be more or less compressed by suitable means.

7244. "Combining electric light appliances with movable furniture, such as chairs, sofas, and settees." A. Gray. Dated May 5. 6d. The inventor forms chambers or receptacles under or within a chair, sofa, or the like, and affixes the desired number of accumulators or secondary batteries therein, these being in connection by "leads," switches, connections, &c., to any lighting medium, also affixed to said chair or sofa, so that the article of furniture shall be readily removable and capable of being set at any desired spot.

7376. "Improvements in electric bell indicators." H. Thorpe. Dated May 7. 6d. The object of this invention is to simplify the construction of electric bell indicators, and thereby to reduce their cost of manufacture, and at the same time increase their efficiency and usefulness.

7380. "Improvements in electric telephones." C. Lever. Dated May 7. 6d. The inventor takes advantage of the electro-capillary action of a polarised column of mercury in a tube of non-conducting material, with dilute sulphuric acid or equivalent electrolyte floating upon the mercury, the whole being, of course, included in an electric circuit. The fig. is a longitudinal section through one form of transmitter, constructed according to the invention. A tube, G, of non-conducting material of small internal diameter, preferably a glass tube, is at its lower end fixed to a small metal cylinder, C (the internal diameter of which may be slightly larger than the external diameter of the glass tube). The cylinder or socket, C, has a screw thread cut on its exterior as shown, or into its exterior, on to which or into which is screwed a small metal cap, A, which is hollowed in its interior and is provided on its outside with a terminal or binding screw, B. The metal cap, A, being screwed in its place, mercury, *m*, *m*, is poured into the glass tube, G, so as to fill the hollow part of the metal cap, A, and glass tube, G, to within a short distance from its open end. It will be seen then that if the said metal cap, A, be screwed backwards or towards, the mercurial column in the glass tube will fall or rise proportionately. Or the cap, A, may be filled with mercury and the latter made to rise as required in the tube, G, by screwing the cap further on to the tube. Floating on the top of the thin mercurial column is a thin float plunger or piston, P, made of wire, or other piece of conducting material, whose specific gravity is less than that of mercury, and which fits easily but accurately into the bore or interior of the glass tube, G. The diaphragm, D, of the transmitter is made of any suitable electric conductor, such as thin ferrotype plate, and is secured by means of metal rims to a case, F, of insulating material of any suitable shape, such, for instance, as that used for Bell's telephone. The glass tube, G, with its attachments, C and A, may be fixed in this case in a similar manner to the permanent bar magnet in the Bell telephone, but it is cemented in the case so as to be perfectly rigid. The piston, P, floating in the column of mercury, *m*, may either bear against the centre of the conducting diaphragm, D, by its buoyancy, in which case it is desirable to platinise the contacts of the wire plunger, P, and diaphragm, D, or the piston, P, may be electrically connected with and fixed to the diaphragm, D. In the latter case it is immaterial whether the specific gravity of the float piston, P, be greater or less than that of mercury. A binding screw, fixed, for instance, in the insulating case, F, is connected electrically to the conducting diaphragm, D, the other binding screw, B, being fixed to the small metal cap, A, as hereinbefore described. The current entering then at the terminal, B, fixed to said metal cap, passes through the mercurial column, *m*, in contact therewith, and through the piston, P, and the diaphragm, D, to the terminal in connection therewith, or *vice versa*. An electrolyte may be substituted in the transmitter for the mercury, but the latter is preferable. The diaphragm, D, may also be made of thin vulcanite, or other non-conductor, but in such case the thin piston must be electrically connected to the terminal on the insulating case by means of a very fine flexible conductor. The action of the transmitter is as follows:—The small metal cap, A, having been adjusted so that the float piston, P, just touches the surface of the mercury, *m*, the current from a battery passes through the diaphragm, D, the piston, P, and the mercurial column, *m*, and through the primary circuit of an induction coil, and back to the battery from the wire, w^1, to the line, or *vice versa*. It is evident, however, that any sound waves produced by the voice, or other sound producer, directed into the mouthpiece of the transmitter, will, by impinging on the diaphragm, D, cause the same to vibrate. These vibrations of the diaphragm will cause the float piston, P, to dip more or less into the mercury, thus varying the resistance of the mercurial column and causing variations in the current flowing through the primary circuit of the induction coil, the secondary circuit of which is connected to line and receiver, thus causing variations of electric tension or electromotive force in this secondary circuit, which will be transmitted through the line to the receiver. The receiver is, according to the invention, constructed in a similar manner to the transmitter, and so that they may be interchanged or reversed in action.



7436. "Improvements in means for regulating the supply of gas in railway trains by electricity." W. E. Langdon. Dated May 8. 6d. The object of this invention is to provide a means for turning the gas employed for illuminating railway carriages up or down as may be required. To this end the inventor employs an electro-magnet, to the armature of which he attaches a stop-cock or valve, and he so arranges the armature that it shall be operated in one direction, that is, away from the cores of the electro-magnet, by means of a spring or by gravity; and in the other direction, that is towards the cores of the armature, by the magnetism imparted to the said cores by the electric current when passing through the coils of the electro-magnet. Thus by the operation of the armature he opens or shuts, or nearly shuts as may be necessary, the cock or valve through which the gas has to pass in order to reach the gas burners placed in the carriage. One of these electro-magnets and valves is placed upon each carriage, or at such points as may be requisite for the necessary control of the consumption of the gas, and the inventor connects it or them by a wire or by wires electrically with a switch or commutator and battery placed in the guard's van or other convenient spot, so that the guard or other appointed officer may at his will, by handling the switch or commutator in one direction, so influence the armature that it shall close, or nearly close, the gas valve in connection with it, and by handling it in the opposite direction he shall open it.

7439. "Improved portable apparatus for electric lighting purposes." A. M. Clark. (Communicated from abroad by G. Trouvé, of Paris.) Dated May 8. 8d. Relates to the apparatus described in the No. of the Review for Dec. 6th, 1884.

7548. "Improvements in the anchoring of telegraph poles." R. H. Twigg and J. C. Johnson. Dated May 10. 4d. The inventors attach to that portion of telegraph poles which is inserted in the ground two anchors; one at or near the surface of the ground, the other at or near the lowest extremity of the pole.

7717. "Improvements in telephone transmitters." W. R. Lake. (Communicated from abroad by J. A. Kingsbury, of America.) Dated May 14. 6d. Comprises a spring-point which has a continuous bearing on the inside of the diaphragm and connects with, and disconnects from, another spring by means of which the connections are made and broken instead of the connections being made and broken by the point on the diaphragm. In this respect the improved transmitters differ essentially from other transmitters, by the fact that in the improved device the sound is produced at the opening of the current; whilst ordinarily the sound is produced at the closing of the current.

7829. 'A new or improved galvanic element." A. M. Clark. (Communicated from abroad by Wirth & Co., of Frankfurt-on-Main, patent agents, acting as the attorneys of Alfred Dun, also of Frankfurt.) Dated May 16. 4d. The element consists of two cells, and differs essentially from those now used in this, viz., that both the outer and inner cells contain the same solution as exciting fluid, but in different degrees of strength; that in the cell for the carbon electrode is made very strong, whilst that in the cell for the positive electrode is weak. It has been ascertained that by the difference in the degree of strength in one and the same solution all those conditions are fulfilled which are necessary for a very constant battery, and which, up to the present, it was believed could only be obtained by the use of two different solutions in the two cells. The weak solution serves as a dissolving moment for the positive electrode, whilst the strong solution in combination with the carbon acts as a depolariser.

10298. "Improvements in medical electric hair brushes and apparatus." W. S. FROST, J. L. MERIGOT, and G. C. C. FEIN. Dated July 18. 6d. The inventors provide the brush with metallic bristles, preferably of crimped German silver, in clusters, rows or groups, which they prefer to isolate from each other by ordinary bristles, but which may be isolated by being set at some distance apart or by any suitable non-conducting material, so that when connected with the electrical arrangement at the back of the brush, as hereinafter described, certain groups, clusters, or rows form the positive and others the negative pole of an electric circuit. In the back of the brush they form a case or box made of insulated material, in which is placed a medical or an induction coil, with a suitable battery to work the same.

CORRESPONDENCE.

Electric Lighting in Belfast.

In your "Notes" of last week's issue you gave a list of some arc lights in Belfast which were fitted up by Mr. McCarthy, and you stated that the lighting of High Street failed owing to some persons short-circuiting the cables on the roof.

Any stranger reading this would infer that *no* lights in High Street were successful. Permit me to state that *all* which were erected by me were entirely satisfactory, not only in High Street but elsewhere, and I have been congratulated on the result in all directions.

It seems a strange statement that the failure of the others is attributed to "short circuiting" by some persons on the roof. I am perfectly certain that no one having access to the roofs would be guilty of so dastardly an action. If, however, such had been the case, why was the fault not discovered the next day, or day after, and remedied before the time for lighting up?

J. H. Greenhill.

Belfast, 13*th May*, 1885.

Re-winding Dynamos.

I had not intended to write further on this question, but the sight of my formula mangled beyond recognition in your issue of the 9th, induces me to offer a few concluding remarks.

In my first communication the truth of Mr. Moon's formulæ is not denied. It is acknowledged that his formulæ lead to the desired result, but it is pointed out that the same result may be obtained by a different method, and numerical examples of the two methods are given.

In his last communication Mr. Moon, after a few playful thrusts, declares himself in a position to show that my rules and figures are totally incorrect. This arrogant statement, however, on examination turns out to be nothing more than a mild expression of displeasure at my having given his formulæ a shape which, taken in conjunction with my former communication, renders it somewhat more convenient for the argument. About the accuracy of the formulæ and figures there is no question whatever, and Mr. Moon's anticipated failure to prove both wrong is most complete. It will be observed by your readers that Mr. Moon carefully avoids reference to the figures given by him in a previous letter. Does Mr. Moon still maintain that those figures are correct, or does he not?

The third formula I gave is applicable to the case in which the field-magnets only are re-wound, and it is *not* obtained by adding together the first and second equations. Mr. Moon with characteristic carelessness, distorts the equation by substituting r_1 for r on the right hand side, making it consequently meaningless. With a mode of criticism which allows of this kind of thing I am not familiar, and further discussion under the circumstances is therefore superfluous.

W. B. Esson.

May 10*th*, 1885.

Pocket Batteries.

Could you kindly inform me on the following. I have a pocket bichromate battery of two cells, the case being made of gutta percha; when it has been at work a few minutes the gutta percha on the one cell goes soft and the other keeps quite cool. If I change the carbons and zincs into the opposite cells, the other side goes soft. Could you kindly let me know through your paper the cause, and what remedy?

J. C. Aston.

Smallbrook Street, Birmingham,
May 9*th*, 1885.

[Probably some of our readers may be able to help our correspondent out of his difficulty.—EDS. ELEC. REV.]

Professor Thompson's Telephonic Apparatus.

Will you or one of your correspondents kindly give the number of Prof. S. P. Thompson's patent for his "nest" telephone, as illustrated in your issue for May 9th.

As regards the membrane receiver of Prof. Thompson, it appears to be somewhat wanting in novelty.

For a substantially similar membrane arrangement see Eldred's patent, No. 676, 1883. And for exactly the same magnet and pole piece system, see second edition Hospitalier's "Modern Applications of Electricity," vol. II., p. 36, where the "D'Arsonval" telephone is described.

Prof. Thompson's telephone arrangement with his "plug" magnet seems complicated and not very practical, requiring as it does extra battery power.

"Telephonist."

May 11*th*, 1885.

[No. 8732, 1884.—EDS. ELEC. REV.]

Text Books on Electrical Measurements.

"Novice" will find in Munro and Jamieson's "Electrical Pocket Book" (Charles Griffin & Co.). pages 14 to 16 also 330 to 345, a thorough explanation of what he requires; I have found it useful.

"Partick."

May 11*th*, 1885.

"The Grouping System in Electric Lighting."

With reference to the letter of Rear-Admiral Arthur which appeared in your last issue, will you allow me to point out that the provisions of the New Patent Act with regard to the times for the payment of fees extend to patents which were in existence at the date when the Act came into operation. Consequently the patent No. 2128, 1882, will remain in force until May 5th next year, without any further payment.

Thos. J. Handford.

42, Southampton Buildings,
May 12*th*.

Portable Electric Lamps.

In the last number of your esteemed journal I noticed a portable lamp of M. Larochelle.

I should be very much obliged if you or any of your readers would inform me where M. Larochelle lives, or where to get further information about his battery and lamp.

I enclose my card, and remain,

E. S.

Copenhagen, 11*th May*, 1885.

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